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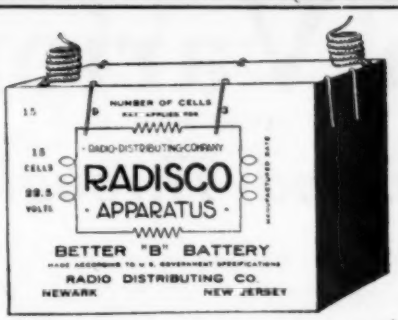

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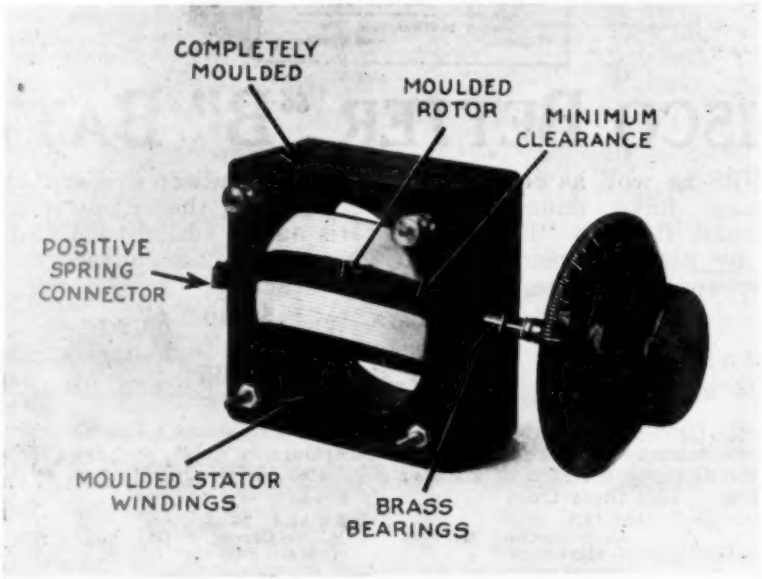

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QST

The Official Organ of the A.R.R.L.

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Q S T is published monthly by The American Radio Relay League, Inc., at Hartford, Conn. Kenneth B. Warner (Secretary, A.R.R.L.), Manager and Editor.
Subscription price in United States, Possessions, and Canada, $2.00 per year. Foreign, $2.50. Single Copies, 20 cents.
Entered as second-class matter May 29, 1919, at the post office of Hartford, Connecticut, under the Act of March 3, 1879.
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QST

A Magazine Devoted Exclusively to the Radio Amateur

The Antenna*

By John C. Stroebel, jr., 8ZW.

There is a surprising dearth of data on aerials and their behavior. We do not know nearly as much about what is good aerial design as we do about the design of the rest of our apparatus. QST therefore feels that Mr. Stroebel's article will be received with welcome and will stimulate some hard clear thinking on the part of our readers.—Editor.

THE main object of this paper is to show how the fundamental wave length of an antenna varies according to dimensions apart from its actual length.

Thruout the discussion, unless otherwise stated, it is the fundamental wave length, i.e., the wave length of the antenna alone, without any added inductance or capacity, that is referred to. Standard symbols, λ for wave length, C for capacity, and L for inductance will be used.

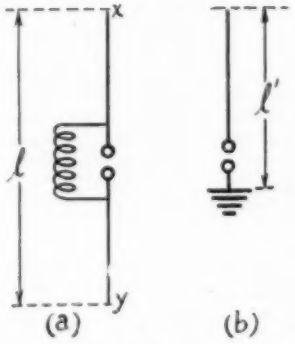


FIG. 1

Consider first a simple Hertzian oscillator of length, l, shown in Fig. 1 (a). An electric charge oscillating from x to y and return, with the velocity of light, sends out ether waves horizontally at the same velocity; hence a pulse moves out a distance of $2l$ while the charge goes thru one complete cycle. This distance moved will be one wave length, λ. Thus $\lambda=2l$; i.e., the wave length will be twice length of the oscillator.

If the upper half only of the oscillator is used, and a ground connection substituted for the lower half as is usually done in practise, it does not change the frequency or λ materially; thus for a single vertical wire connected to earth, $\lambda=4l'$ [See Fig. 1 (b)]; i.e., fundamental wave length equals four times the total length of wire.

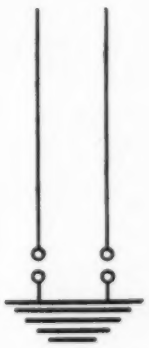


FIG. 2

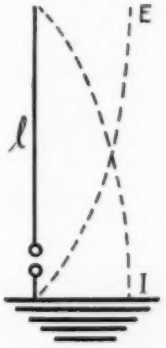


FIG. 3

A simple vertical wire antenna is rarely used in practise. Maximum efficiency results when the working wave, obtained by inserting a few turns of inductance in series, is not greatly in excess of the fundamental. The height necessary to obtain even a comparatively short wave length in a vertical aerial makes construction difficult and cost prohibitive. Therefore the usual practise is to go as high as possible vertically and then run

* A paper read before the Second Annual Convention of the Third Amateur Radio District at Philadelphia, Feb. 26th.

out horizontally, forming the inverted L antenna.

Where the horizontal part is comparatively high above the earth and the horizontal length not much over twice the height, the wave length of a single inverted L wire is not materially different from that of a simple vertical wire of same total length; i.e., $\lambda = 4l$.

A single wire has rather low capacity, hence large powers build up excessive potentials, making losses high, insulation difficult and efficiency low. Increasing the number of wires increases C and overcomes these difficulties but complicates the determination of the fundamental λ. Besides possessing a certain capacity, C, an antenna has a certain inductance, L. The C is due to the shape and intensity of the electrostatic field around the antenna when fully charged. The L is due to the shape and intensity of the magnetic field set up around the wires by the oscillating current on discharge.

When a complex form of antenna is used its wave length is usually influenced and determined by factors aside from its actual length. If the L and C are known, λ may be determined by means of the formula $\lambda = 59.6 \sqrt{(LC)}$, where λ = wave length in meters, L the inductance in centimeters (cm.) and C the capacity in microfarads (μf). Evidently anything that influences L or C will influence λ, so λ is proportional to $\sqrt{(LC)}$. This $\sqrt{(LC)}$ is known as the oscillation constant.

A simple application of this formula follows: An antenna of length l has a certain L and C and therefore a certain λ. If the length l is doubled, both L and C are doubled, making the product LC four times its former value. But $\sqrt{(LC)}$ will be only twice the former value, hence doubling length of an antenna doubles λ. Two antennas having the same oscillation constant, i.e., the same product of L and C, will have the same λ regardless of the individual values of L and C.

Now let us see what effect an increase in the number of wires has upon the wave length. Consider two wires, either vertical or inverted L, spaced a uniform distance thruout their length, from tip to ground. The extent of the electrostatic field is increased and therefore C is increased. But the magnetic field is now divided between the two conductors and the electrical inertia or self inductance, L, has been decreased to same extent that C was increased so that $\sqrt{(LC)}$ and therefore λ remains the same as before. Increasing the number of wires increases C but further reduces L, maintaining $\sqrt{(LC)}$ and λ constant so that for any number of wires *uniformly spaced thruout* their length λ is the same as that of a single wire of the entire system, which equals approximately $4l$.

Manifestly in practise the wires must be brought together at the lead-in to connect thru a single receiving or transmitting apparatus to ground, so that L is decreased somewhat less than C is increased by use of multiple wires, resulting in a $\sqrt{(LC)}$ and λ somewhat higher than that of single wire. But it will be shown that the point at which the bunching of the leads occurs determines what the increase of λ will be.

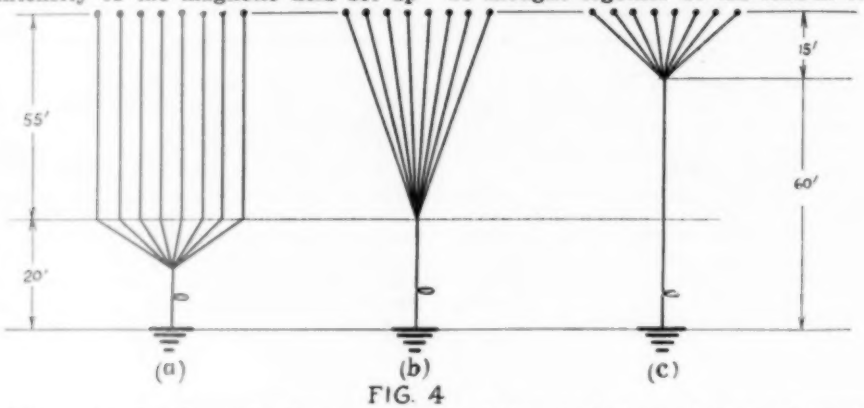


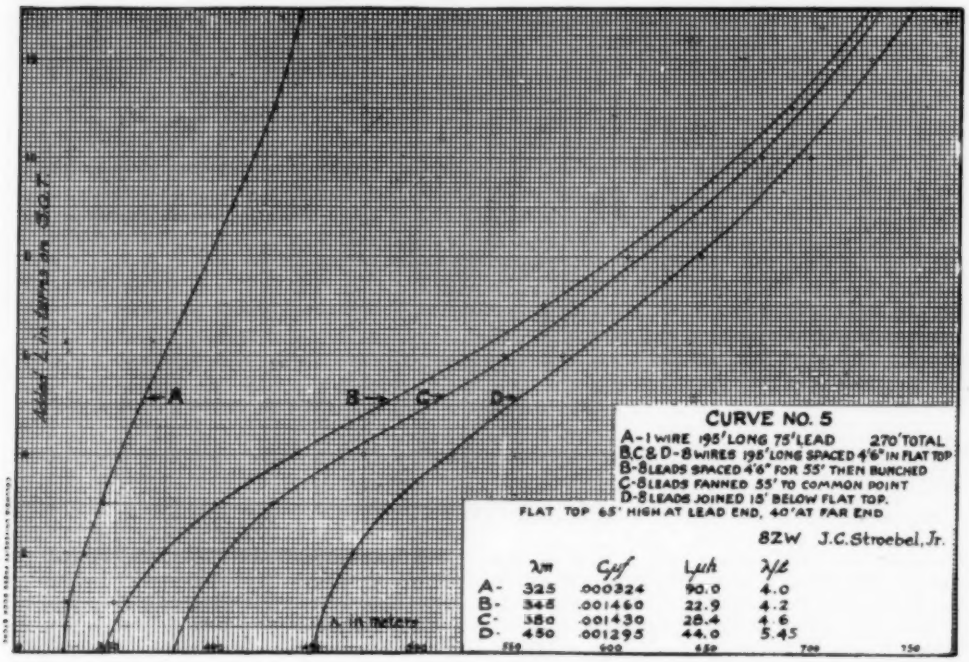
FIG. 4

It is advisable at this point to consider the voltage and current distribution along an antenna system. This distribution is *non-uniform* and the effective C and effective L are influenced very decidedly by this non-uniform distribution. See Fig. 3. The voltage, E, is zero at the base of an antenna and a maximum at the free end. Conversely the current, I, is greatest at the base and zero at the far end. The rise or fall of E or I as we proceed from the base to the far end is not uniform but varies approximately according to curves shown in Fig. 3.

The intensity of the electrostatic field between antenna and earth being greatest at the point of maximum potential, the

effective capacity of any form of complex antenna is increased by fanning out the wires at the far end. Conversely, the maximum current being greatest at the base of the antenna, a single conductor or rat-tail of closely bunched wires for the lead will concentrate the magnetic field and give a maximum effective inductance.

Thus in an inverted L (or T) antenna, the wide separation of the wires in the horizontal part (or especially at the far end) and the bunching of the lead into a single rat-tail, gives the conditions of both maximum C and maximum L, hence maximum λ for a given total length of antenna; and λ often reaches $6l$ instead of $4l$ (as for a single wire). The extreme case for


CURVE NO. 5
A-1 WIRE 195' LONG 75' LEAD 270' TOTAL
B,C & D-8 WIRES 195' LONG SPACED 4'6" IN FLAT TOP
B-8 LEADS SPACED 4'6" FOR 55' THEN BUNCHED
C-8 LEADS FANNED 55' TO COMMON POINT
D-8 LEADS JOINED 15' BELOW FLAT TOP.
FLAT TOP 65' HIGH AT LEAD END, 40' AT FAR END
8ZW J.C. Stroebel, Jr.
λm Cμf Lμh λ/l
A- 325 .000324 90.0 4.0
B- 348 .001460 22.9 4.2
C- 380 .001430 28.4 4.6
D- 450 .001295 44.0 5.45
A
B
C
D
λ in Meters

these conditions occurs in the umbrella antenna where λ may reach a value of $8l$.

The effective C of an antenna is also increased to some extent by decreasing the height of the free end above the earth but in practical work this effect is usually negligible (except where the free end is very low, in which case C and therefore λ may materially increase.) Therefore the λ of an inverted L antenna of uniformly spaced wires is approximately the same as that of a vertical system of the same linear dimensions, and as already stated $\lambda = 4l$.

In a given horizontal system, if the lead be taken off the center instead of from one end, the T antenna results. L and C are both reduced, consequently the λ of the T will be less than the inverted L type. The total length in this case is sometimes figured as vertical length plus ½ of the total horizontal length. This is only approximately correct, as the fundamental λ of a T type 100 ft. long and 50 ft. high will be somewhat greater than that of an inverted L type 50 ft. long and 50 ft. high but considerably less than the λ of an inverted L type 100 ft. long and 50 ft. high.

The T type is no doubt the best all round antenna for general amateur or other work that must be carried on on restricted wave lengths. Directional effects in both transmitting and receiving are not nearly so pronounced in the T as in the inverted L type.

The fan or harp antenna is possibly best of all but due to the excessive height required for large C and efficient work, constructional difficulties and cost make it beyond the reach of the average amateur. Its directional effect is small, the radiating qualities are considered good, and the wave length is usually low enough to work on short waves without difficulty. However, a properly designed inverted L or T may be equally or nearly as good as a fan.

It would seem that an antenna which covers the maximum length and spread of wires for a given fundamental λ would best suit the needs of the amateur. This results when wide separation of both horizontal and vertical wires is made use

of. Consider the type of inverted L antenna often used where widely spaced wires in the flat top are terminated by a lead or rat-tail of wires closely bunched just below the flat top. As previously stated this gives conditions of both maximum L and maximum C and therefore maximum λ for a given overall length. If these closely bunched leads are separated as in flat top, until very close to the lead-in insulator, the fundamental λ will be less than before, and this without cutting down the total length a particle. The reason is easily seen. Separating the leads has increased the effective C, but only slightly since we are at the low voltage end of antenna. On the contrary the effective L has been *decreased* considerably since we have separated the wires at the maximum current end. And since L has decreased more than C has increased, $\sqrt{(LC)}$ and therefore λ has decreased. The above theory has been fully verified thruout by experimental evidence.

A number of measurements have been made of several different types of aerials used at 8ZW. In one case, variations of the wave length of an antenna using different types of leads are shown in the curves of Fig. 5. The flat top used in each case consisted of 8 wires 195 ft. long spaced 4.5 ft., (32 ft. spreaders) 65 ft. high at lead end, 40 ft. high at far end. Length of lead—including ground—75 ft. Total length of 270 ft. used thruout.

The curves give wave lengths, fundamental and natural, using various values of series inductance on oscillation transformer secondary. Curve B, was obtained with lead of 8 wires separated 4.5 ft. (as in flat-top) for 55 ft., and then converged to a single rat-tail of 8 wires bunched as shown in Fig. 4 (a); curve C, with leads fanned as shown in Fig. 4 (b); curve D, with leads bunched 15 ft. below flat-top as shown in Fig. 4 (c).

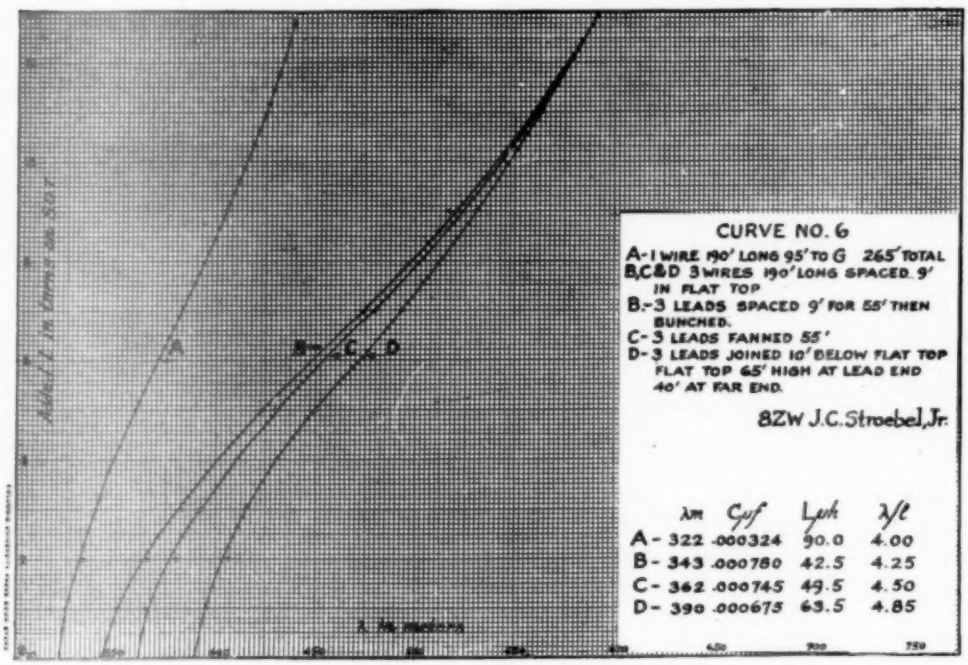

CURVE NO. 6
A-1 WIRE 190' LONG 95' TO G 265' TOTAL
B,C&D 3 WIRES 190' LONG SPACED 9' IN FLAT TOP
B-3 LEADS SPACED 9' FOR 55' THEN BUNCHED.
C-3 LEADS FANNED 55'
D-3 LEADS JOINED 10' BELOW FLAT TOP FLAT TOP 65' HIGH AT LEAD END 40' AT FAR END.
8ZW J.C. Stroebel, Jr.
λm Cμf Lμh λ/l
A- 322 .000324 90.0 4.00
B- 343 .000780 42.5 4.25
C- 362 .000745 49.5 4.50
D- 390 .000675 63.5 4.85

TABLE I

Data for Figs. 4 and 5.

	λ	Cμf	Lμh	Ratio λ/l
Single wire	325	.000324	90.0	4.0
Leads spaced 4'6"	345	.001460	22.9	4.2
Leads fanned	380	.001430	28.4	4.6
Leads bunched	450	.001295	44.0	5.45

Tests were also run on another antenna 190' long, 65' high at lead end, 40' high at far end, lead to ground 75' long, total length 265', first as a single wire, then 3 wires spaced 9' apart, with following results:

TABLE II

	λ	Cμf	Lμh	Ratio λ/l
Single wire	322	.000324	90.0	4.00
Leads spaced 9'	343	.000780	42.5	4.25
Leads fanned	362	.000745	49.5	4.50
Leads bunched	390	.000675	63.5	4.85

The curves of Fig. 6 show λ with series L added. Changes in λ with change in lead spacing are not so marked in the second case, due to fewer wires and shorter spreaders used. Both experiments fully verify the theory involved, however.

It may be argued that the aim for maximum efficiency and best radiating qualities is to get the center of capacity as high as possible to produce maximum electrostatic field about the antenna and maximum current with strong magnetic field in and around the lead. And this is usually accomplished by spreading the wires in the flat-top and bunching the leads. However, spreading the leads increases the effective C very little, thus lowering the center of capacity very little. On the contrary spreading the leads decreases the effective L to such an extent that $\sqrt{(LC)}$ and λ are reduced materially, as already pointed out. This reduction would permit the lengthening of the flat-top to increase and restore λ to its original value, with consequent increase of C (materially increasing the effective C since it occurs at the high-potential end) at far end, thus tending to neutralize the effect of the lead capacity to lower the center of C. Therefore the latter will be maintained high above the earth, and the increased length of antenna is clear gain.

Another important point follows. The curves of Fig. 5 and 6 will cross if λ is increased by continued addition of higher values of series L. Since the effective C of an antenna with spread leads is greater than one with bunched leads, a large honeycomb coil will load the former to a longer λ than the latter. Fig. 7 illustrates this. Thus A gives lower minimum and higher maximum λ than B, which is obviously of considerable advantage. Furthermore, spreading the wires in the lead where the current is greatest reduces the skin effect by increasing the area of conductors, thereby reducing high frequency resistance.

Where the leads are separated widely, swinging of leads with consequent changing C is less marked, with little variation of λ on C.W. and phone signals, while wires swinging with respect to external objects would vary C and therefore λ making tuning difficult to maintain. Wires swinging with respect to each other should have little effect, since wider separation would increase C but decrease L (closer swinging decrease C and increase L), thus maintaining $\sqrt{(LC)}$ and λ practically constant.

Several well known points may be mentioned in passing. The high-potential far end requires better insulation than other parts of an antenna. The importance of getting all wires exactly the same length must be emphasized. Especially if a T type antenna is used, wires should be taken from the *exact* center, since it is hard to see how oscillations can traverse unequal lengths of wire in same time period. Thus double waves would be set up, if lengths are unequal. If local obstructions prevent leads being taken off the extreme end of wires, and a T type is impossible or undesirable, the short ends of the flat-top should be separated from the leads by insulators.

The necessity of having all joints soldered is well known.

Whether the separate wires in a flat-top are all connected together at the ends or left open is largely a matter of individual opinion. If the wires are of unequal length, jumpers may equalize matters and possibly reduce brush discharge slightly, but no other advantage is obvious.

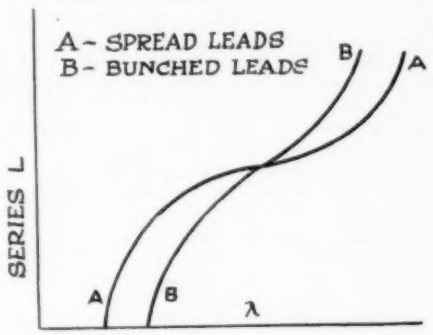


FIG 7

At present the star or cage antenna is in use at 8ZW, and seems to be best type yet tried out. Five wires on X spreaders 18′ long form flat top. A wire is run from the end of each spreader and one from the center of the X. Separate leads are brought down to another X spreader 9′ long, near the lead-in insulator, and finally bunched where the wires enter thru plate glass window. The average length of horizontal wires is 125 ft., average height 70 ft., total length of each wire from ground to far end exactly equal—210 ft. Additional data and constants may be available at a later time.

The writer has not attempted to exhaust the subject but rather to point out certain general and underlying principles that will enable all to get a clearer understanding of the matter and settle much of the doubt which seems to exist in the minds of many experimenters as to the best type of antenna.

The second article on The Ideal Spark Transmitter, by R. C. Denny, 6CS, will appear in the next QST. Watch for it.

Breaking Out

By M. Adaire Garmhausen

"Strike the concertina's melancholy string,
Blow the spirit-stirring harp like anything,
Let the piano's martial blast
Rouse the echoes of the past,
For of Hook-up, King of Maladies, I sing."

DON'T get nervous, I'm not going to sing; that's poetic license. What I mean is, I'm going to discuss that terrible affliction, common, I suppose, to all of us, known as "breaking out with the Hookups." Perhaps to those who profess to be authorities on CW and "sich like" this phase of the ham business is ancient history, and yet I have an idea that it is a repeating disease, and that you never can be sure just when it is going to break out again.

Say the first spell comes over you as you are looking thru an old trunk, or pile of old magazines, and you find the diagram the Independent used in wiring the Ark. Just for the fun of it, you fall to and dig up that last piece of galena you discarded back in 1492, and try Noah's diagram; after you get it all connected up the signals are so faint that you can't be sure whether it's working or not. Can it be that you ever actually depended on that silly little crystal! Why you can't even hear 2RK! Oh my, you couldn't possibly get along without hearing 2RK, so

"....put the Crystal in your ear and your ear to the ground...."

you kick it across the room and turn to the cheerful little bulbs on the table. And then, in your zeal, you burn out one or more of said bulbs. Oh mother, another week's salary gone wrong! This is too much; you simply can't afford to buy another bulb this year. Then you start to THINK. Why monkey with a lot of apparatus! Somebody ought to invent apparatusless wireless! Why not you! Your eye falls on the loathsome crystal. Let's see now—here's a start. If you connect the aerial directly to the ground, put the crystal in your ear, and your ear to the ground why couldn't you hear POZ? While in the act of carrying out this experiment an angleworm comes up and strolls across your face, so you abandon the project and decide to retain a little apparatus for the

"....a dim idea that you might discover something about crystals."

time being. It would never do in southern countries anyway—you might put your ear on an anthill or a rattlesnake—horrors!

Back to the antediluvian magazines—and you find a bunch of crystal hook-ups. Thereafter, days and nights are spent in trying and discarding each. Perhaps you have a dim idea that you might discover something immensely important about crystals. Unfortunately each and every diagram seems to call for at least one small but urgent piece of apparatus which you do not possess, and still more unfortunately, none of the hook-ups give what even the most tolerant could call results. You can't kick it away now because by this time you have completely walled yourself in with discarded junk, so you throw it as high over the wreckage as you can reach and turn again to the bulbs. Even if all the crystal's secrets are bared to Science, those of the bulb aren't. Maybe you could find a way to make the remaining bulbs do the same work as the original number. So you fall to work with redoubled vigor determined to startle the world with your discovery. As each idea fails your enthusiasm wanes and then suddenly you show the first glimmer of returning intelligence. You realize that the money you wasted on the crystal

hook-ups would have bought you two bulbs, and that as long as you were getting perfect efficiency out of your old arrangement

"Hams (m.) do this....hams (f.) burst into tears.

it was foolish to change it. The disease has now spent its fury and you have spent every cent you own, so you sell the family jewels, replace the burnt-out bulbs, and hook them up exactly as they were originally.

I suppose this malady attacks different ones with different degrees of violence, but any case is bad. You break out first with a bunch of new ideas, you break out into profanity when they do not—[hams (m) do this, I am told; hams (f.) burst into tears]. Now that I have safely passed thru my first attack I consider myself one of the gang, other peoples' opinions to the contrary notwithstanding! I have piles of worthless junk lying around, and my room looks more like a blacksmith's shop than a young lady's "boojwar," but I can't say I am any the wiser. My sore and swollen fingers have taught me when to use pliers and the smell of burning shellac has taught me not to put twelve volts on a six volt buzzer. They told me I followed the customary rule in breaking in, so I guess I broke out the usual way, too. Did I?

The $100 C.W. Set

By K. B. Warner.

A WESTERN amateur writes us as follows:

"In the March issue, just received, you say that mile for mile C.W. transmission sets may be put in as cheaply as spark. I hope you are correct in this statement and, knowing nothing about it, I am going to ask you to devote space enough in QST to back up your statement by outlining in a general way a C.W. set that will transmit as far as a $100.00 spark set consisting of

Transformer (1 k.w.)	$30.00
Condenser	30.00
Rotary Gap	30.00
O.T. (home-made)	10.00
	$100.00

"Can you show me, and many others, how to put in a C.W. set for $100.00 that will transmit as far as such a 1 k.w. spark set? If so, such an article in QST will meet with much approval."

The General Design

We gladly accept the challenge. The problem is not very difficult. First we should consider the power necessary, and we're going to prescribe 20 watts of C.W. energy. Half that probably would be sufficient, but we can afford 20 watts on the basis of a $100 set. If anyone think us over-optimistic, let them remember that spark sets are rated on their input and American vacuum tubes on their antenna output. Fifteen percent overall efficiency probably is a fair average for amateur spark sets, making 150 watts in the aerial circuit. No one, we trust, will question that 20 watts of straight C.W. energy is the equal of 150 watts of spark-train energy.

As to plate supply: If we had to figure on a motor-generator set, or a step-up transformer and kenatron or electrolytic rectifiers and a filter, we admit the problem of building a 20-watt set for $100 would be difficult if not impossible. However, as we have endeavored to point out before, recent developments in the use of A.C. on the plate without extra appurtenances, in circuits where the action is called "self-rectifying" (as originally described in QST for December, 1920, and further discussed on pp. 51-52 of QST for February, 1921, q.v.), has provided a solution to the matter. A.C. is transformed to the required voltage and more or less smoothed out by a large choke—no other apparatus is necessary for the plate supply and the system lends itself well to our use. We shall therefore use self-rectification.

There is a world of oscillating circuits but those performing best these days are the simpler ones using just a plain helix

one of several good schemes. Since we can use an ordinary helix we may promptly dismiss visions of costly coil systems with sliding couplings, rotatable ticklers, etc.

In the following paragraphs we will describe the installation and operation of a 20-watt C.W. set calling for the following material:

4—U.V. 202 Radiotrons, 5 watt, @ $8.00	$32.00
4—good Sockets @ $1.75	7.00
4—Rheostats able to carry 2½ a. @ $2.00	8.00
1—C.W. Helix	10.00
1—ordinary air Variable Condenser, small	5.00
1—C.W. Transformer, supplying plates and filaments	26.00
1—iron-core Choke of high reactance	9.00
2—small glass Condensers, and Sundries	3.00
	$100.00

The Plate Supply

Our readers are asked to review the beforementioned articles on self-rectification, as we cannot herein again go thru the theory. A in Fig. 1 represents an A.C. supply to a tube whereby one half of the A.C. wave is utilized and the other (when the plate is negative) is lost. Connections to the left, as indicated by arrows, would go to the oscillating circuit. Then referring to B in Fig. 1 it should not be hard to see that if there were *two* tubes, and *two* transformer secondaries, so that one plate or the other would be positive, both halves of the cycles would be used, the tubes alternating in oscillating. The plate lead to the oscillating circuit is taken from the center point between two blocking condensers which are necessary to prevent shorting the transformer. Now as discussed particularly on page 52 of February QST, the two half-cycle waves overlap in the antenna circuit, producing a continuous output. If a large reactance is connected at X, Fig. 1-B, the supply modulation will be reduced still further. Prof. G. D. Robinson of the U.S. Naval Academy, Annapolis, advises us he has taken oscillographs of such a circuit and, using an iron-core choke at X, finds the output much nearer constant than F of Fig. 4, page 52, February QST. The Radio Corporation of America is bringing out such a set for amateur use, and a 50-watt model of same when tested at 2ZL, New York, was heard at 5ZA, Roswell, N. M. 8XK, Pittsburgh, reported 3000 miles, uses self-rectification; Mr. Conrad's results prove what can be done. Using a 125-henry reactance at X, rather the ultimate in chokes, he finds the supply modulation *in the antenna* reduced to as little as 5%. Do these results satisfy our readers that the scheme is practical?

It distinctly is to be understood that this circuit is absolutely unsuited to non-oscillating reception. The idea is to iron out the 60 cycle hum by the choke at X, and heterodyne it at the receiver the same as if the supply were D.C.

Now refer to Fig. 2, wherein these principles are applied. The transformer used is a so-called "CW transformer", of which there are several makes on the market. Originally intended for kenatron rectification they already have a double secondary and a filament winding, both with center taps. Other such transformers will shortly be available. For best results with U.V. 202's the voltage across *each side* of the secondary should be about 1000. This allows for a reasonable drop in the choke L_2. Altho still higher than the rated

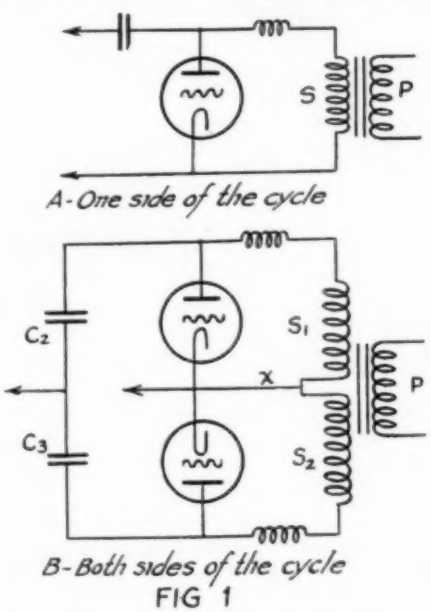


FIG 1

voltage of the tubes, remember that neat dissipation is the limiting factor in their rating and in this circuit any one tube will be idle 50% of the time; therefore much higher voltages may be used in entire safety. The size of C.W. Transformer commonly called "200 watts" is about right for this circuit. Altho such output is higher than necessary for the plates of these tubes, it should be remembered that the filaments also are to be lighted by the transformer, and some leeway is further desirable to provide for increase in the number of tubes if later desired.

The secondary center tap going to the filaments, the outside terminals go to the plates. The tubes are divided into two groups of two tubes each, all filaments and grids in parallel, and the plates of each pair paralleled to receive the voltage. L_2

and L_4 are high frequency chokes to prevent the oscillations from backing up thru the transformer, and are essential. Honeycombs of 200 or more turns are recommended here, but any similar inductance will do. Blocking condensers C_2 and C_3 are inserted between the two pairs of plates, with a center connection to the oscillating circuit. Any capacity in the neighborhood of .002 mfd. is proper here. The builder will note that one condenser of .004 mfd., with a center tap, will be the same. Four glass plates 8" x 10", with tinfoils on each side 6" x 8", with a center tap, answer well and cost very little.

The center tap of the filament winding is the common point for attachment to other circuits. The key and the choke L_2 are inserted in the lead from this point to the secondary center tap. If L_2 were infinitely large in reactance, practically all supply modulation would be ironed out. If no reactance is used, the "60-cycle hum" is bothersome. The value used will depend on the extent to which the builder cares to go in search of perfection. Experimental use may be made of transformer windings, etc., already available, but they should be of relatively low ohmic resistance. We would sugest 25 henries as a practical value, altho pointing out that the cost allowed for this item will hardly procure a choke of such value. The Radio Corporation of America promises the amateurs special chokes for this purpose very soon. An open core choke that will operate very satisfactorily in this location can be made of core iron in a single leg 2 inches square in cross section, 10 inches long, with a winding space between heads of about 9½ inches. After insulating the core, wind on 5 lbs. of No. 26 B&S enameled wire, in smooth layers, inserting 3-mil craft paper or waxed paper between layers until the entire 5 lbs. has been used.

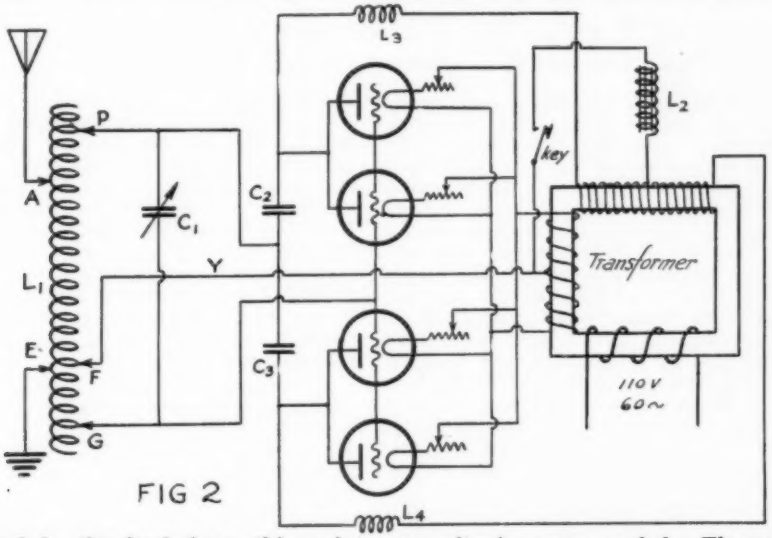


FIG 2

The Oscillating Circuit.

The circuit here shown is the Hartley, known by its users as a "sure-fire oscillator." L_1 may be any of the good C.W. inductances on the market; or homemade, such as 40 turns of No. 6 solid copper wire, small copper tubing, or edgewise-wound copper strip, about 6 inches diameter, and with turns as close as convenient. Five clips should be provided. The condenser C_1 is a concession to convenience—with exactly proper tuning it is unnecessary and its use causes a slight loss, but it is immensely convenient in tuning and its use at small values of capacity is recommended. The position of clip F determines the feed-back voltage to the grids, and is one of the major adjustments. The inductance between A and E determines the wave length, but with changes in the position of F both A and E should be shifted so as to keep E as close to F as possible, thereby maintaining the filament circuits at substantially ground potential.

The users of this circuit have found a grid condenser or C battery unnecessary, the circuit arrangement probably biasing the grid sufficiently. Should trouble be had on this account, a condenser and leak may be inserted in the grid lead.

The Hartley circuit of course is not the only one that can be used in this set. The same inductance L_1 and an oil-immersed variable will make possible the use of the well-known Colpitts circuit; leads P, F and G of this tube equipment being connected to the points customarily occupied by plate, filament and grid connections, respectively,

in the Colpitts circuit.

It is almost unnecessary to add that meters to read current in the plate, filament and antenna circuits are the next thing to imperative for maximum results.

Telephony.

If a high-reactance choke is used at L_2, telephony may be employed with results as good as with D.C. supply. 8XK's phone is A.C., and his modulation is obtained by using additional tubes (of course arranged to use both sides of the cycle just like this oscillator) in parallel to the oscillating tubes, in the Heising "constant-current" circuit. With a condenser in the grid circuit of Fig. 2, grid-leak modulation may be used, or for experimental purposes a Ford coil may be used at Y in Fig. 2 after the manner suggested by Mr. F. S. Huddy in Fig. 2 of his article elsewhere in this issue.

Conclusion.

The foregoing embodies the latest data which QST has on simple Amateur C.W. The set described will work rings around a 1 k.w. spark set, and if the transformer is of sufficient output the power may be increased whenever desired by simply adding another tube on each side of the circuit.

Performance of January QSS Recorders

—1AW wins close decision over 1TS and 4EA in Prize Contest for January Fading Test Recorders—

THE Bureau of Standards, acting as judges in the contest for the cash prizes to the best recorders in the January Fading Tests, experienced no little difficulty in rendering a final decision upon the relative merits of so large a number of almost equally able A1 recorders. The contest was exceptionally close, and while the very creditable records of Mr. H. P. Maxim, 1AW, Hartford, Conn., were finally selected as deserving of first place they were nearly equalled by those of Mr. D. H. Mix, 1TS, Bristol, Conn., and Mr. A. W. Parker, 4EA, New Bern, N. C., who were chosen for second and third prizes respectively.

In the process of selecting the winners, the first problem to confront the judges was that of fixing some standard for the comparison of the records. To meet this need, the following method of grading was finally adopted, as being the most fair and impartial of any available plan.

Points Considered	Relative Weight In Per Cent
Number of records	50
Quality of records	35
Information on atmospheric conditions	10
Station description	05
Total	100

In using this system, which attaches such a relatively great importance to the number of records, it was soon found that all recorders credited with thirty or more records were distinctly eligible for first honors, and accordingly, the records of those falling into this class were carefully considered until the final decisions were reached.

In order to maintain a uniform practice in grading the number of records, it was necessary to grade each station on a basis of the possible number of records for that particular station. Obviously, a transmitting station could not record a test of its own sending; hence the possible number of records for transmitting stations was less than for stations whose entire time was devoted to receiving. For example, 1AW was graded on a basis of only forty records, while 4EA and most of the other stations, whose only function was recording, were graded on the basis of a possible forty-eight records.

It was also decided unfair to credit recorders with records taken from a very near transmitting station. In such cases the records received from the neighboring transmitting station were not counted, and the recorder's possible number of records was decreased accordingly. In the case of 1TS, the records of 1AW's transmission were not counted, and his possible number of records was reduced from forty-eight to forty. This also applied to 1NAQ 3ZE and others.

The general character of the records received for all the January Tests was exceptionally good. The following list of recorders who submitted over 30 records, with their respective ratings, will serve to illustrate the excellent quality of the work and the close nature of the contest.

Call	Name and Location	Group	No. Records (P.C.)	Grade (P.C.)
1AW	H. P. Maxim and L. A. Morrow Hartford, Conn.	A	83.3	82
1TS	D. H. Mix, Bristol, Conn.	A	77.0	81
4EA	A. W. Parker, New Bern, N. C.	B	83.3	80
8BQ	H. M. Walleze, Milton, Pa.	B	91.6	79

8MT	R. M. Sincock and J. G. McKinley, Uniontown, Pa.....	A	77.0	79
8ML	F. M. Murphy, Cleveland, O.....	B	70.8	79
3ZE	H. A. Snow, Washington, D. C.....	B	68.8	78
8DT	F. J. DeMarest, Williamsport, Pa.....	A	81.3	76
8IK	K. G. Preston, Ashland, O.....	A	81.3	76
1AK	H. C. Bowen, Fall River, Mass.....	B	85.3	76
8EF	A. G. Heck, Manningtón, W. Va.....	B	81.3	76
1NAQ	J. C. Randall, Hartford, Conn.....	B	79.2	75
8ZD	B. P. Williams, Pittsburgh, Pa.....	A	73.0	75
9ME	Slagle and Kinney, Ft. Wayne, Ind...	A.	72.8	75
3AR	A. P. McDowell, Philadelphia, Pa.....	B	70.8	74
1CK	P. F. Robinson and F. M. Oliver, Braintree, Mass.....	A	64.5	72
8DV	J. E. Ahrend, Monaca, Pa.....	A	66.6	72
8ZL	Mr. and Mrs. Charles Candler, St. Mary's, O.....	A	81.3	72
2ZM	L. M. Spangenberg, Clifton, N. J.....	A	73.0	70
3CS	F. G. Raser, Trenton, N. J.....	A	68.8	70
3BD	W. L. Anspach, Philadelphia, Pa.....	A	62.5	70
8ZW	J. C. Strobel, Wheeling, W. Va.....	A	73.0	67
8VB	C. Mathews, Marlette, Mich.....	A	62.5	65
8ZF	M. H. Pancost, Lansing, Mich.....	B	66.6	64
5ZP	H. E. DeBen, New Orleans, La.....	A	66.6	62
9OX	C. F. Pflum, and J. A. Kolb, Louisville, Ky.....	A	66.6	62
8ACH	J. A. Victoreen, and P. A. Frantz, Cleveland, O.....	A	62.5	60
9FQ	L. Pfeiler, and G. Riddell, Sheboygan, Wisc.....	A	62.5	57
4AL	C. W. Clodfelter, Winston-Salem, N. C...	B	62.5	50

Failure of the Transatlantic Tests

AS our readers know, on February 1st, 3d and 5th some two dozen American stations transmitted prearranged signals which were listened for by a large number of British experimenters in the hope of getting across, with prizes offered by manufacturers on both sides for the best performance of their respective amateurs. The U. S. stations transmitting were 1HAA, 2RK, 2ZL, 1UD, 1DA, 1RU, 1XV, 1AW, 1AF, 9ET, 2ABR, 8AB, 2BK, 2DX, 1AK, 1RV, 2ABE, 3SM, 8XA, 2EB, 1GH, 1BBO, 1DB, 2QR, and 1BBK; while in the United Kingdom over 250 amateurs enrolled their names with Mr. Philip R. Coursey, B.Sc., organizer of that end of the tests, from which entrants some thirty logs of signals received were handed to "The Wireless World" for examination.

The arrangements on this side were in the hands of our Operating Department, at the request of Mr. M. B. Sleeper, originator of the plan, and arbitrary signals were assigned for transmission by various entrants. In England, then, a careful examination of the receiving logs against the confidential copy of the assigned signals would show who had been heard. After careful checking it can be said that not one entrant received a single word or signal which *unquestionably* can be attributed to an American amateur station. We are now in receipt of a letter from Mr. Coursey, amplifying upon his cablegram reporting the failure of the tests, and adding the information that in spite of the inability definitely to assign to American amateur sources any of the received signals, a number of their best equipped stations were able just to hear extremely faint C.W. signals on 200 meters which, however, were far too faint to be read for checking up with the schedules. These results were attained only by many stages of amplification, in many cases as many as eight or ten steps being used. With this super-amplification the British contestants had two big difficulties with which to contend: first, harmonics from commercial stations, which were of great bother; and, second, jamming from other entrants by radiation from their oscillating receiving valves. This is contrary to law in Great Britain, which we must remember is of very small area in comparison with our country—so much so that it has been found necessary to prescribe that all heterodyning shall be by a separate oscillator. On such high amplification it readily can be seen how the radiation of an autodyne receiver completely spoiled the reception for other amateurs in the vicinity.

Naturally we are disappointed in this outcome—the more so as American ex-amateurs have demonstrated that our amateur signals *do* get across all right, and that on an ordinary detector-two-step. Such reception is a new field for British experimenters and they hardly can be expected to show the same performance as an American dyed-in-the-wool ham who has learned how get amateur DX only after

years of patient struggle. We have tested most of the circuits used by the Britishers, and find them one and all decidedly inferior to our standard American regenerative circuit using variometer tuning in secondary and tertiary circuits. We would bet our new spring hat that if a good U.S. amateur with such a set and an Armstrong Super could be sent to England, reception of U.S. amateurs would straightway become commonplace.

We do not mean to deprecate the loyal co-operation shown by our English confreres, however. For the admirably complete way in which they go into a problem we have the greatest respect, and we are most sincerely grateful for their interest and enthusiastic co-operation in this, our first attempt to get overseas on schedule. We will all hope for better luck next time.

Amateur Radio Recovers a Stolen Auto

IN November of last year QST pointed out editorially the splendid service that Citizen Wireless could be to the community in aiding in the recovery of stolen automobiles, and urged A.R.R.L. members to see what co-operative movements could be put into effect in their territories. We have since recounted the work that has been started and described how, in New York City, our editorial was the means by which Sergeant Chas. E. Pearce, in charge of the New York Police Station, KUVS, succeeded after several years of effort in getting the permission of his department to institute the service in New York City. KUVS has broadcasted descriptions of stolen cars nightly at 7:30 and 11:30 on 400 meters, and the information is copied by amateurs in nearby cities and turned over to their police departments.

Now we have the news that a recovery has been made by Amateur Wireless, and credit for the first instance of this kind from New York City goes to Messrs. Richard Frank and Wm. Michel, of Union Hill, N. J., operating station 2TK. KUVS on March 21st included in its broadcast "Alarm No. 1668—Two ton auto truck, painted green; marked on both sides 'Gillen Bros., 34 Twelfth St., Brooklyn'; 97 boxes oranges." This was picked up by Frank and Michel and given to their police. The Union Hill detective force were instructed immediately and within a very few hours the car was discovered in a garage in that city, and New York police advised accordingly. Our congratulations to 2TK.

Other police departments are showing much interest in the New York experiments and officials in many of the smaller towns around the big city are arranging with local amateurs to pick up the broadcasts for them. Jersey City will soon begin work on a police radio station of its own, and other municipalities have the matter under consideration. Meanwhile KUVS continues its broadcasts, and amateurs who have not already reported receiving same will confer a favor on Sergeant Pearce if they will send him a postal acknowledgment, care Police Radio, 240 Center St., as the department desires information on the range of the station.

Transcon Dope

THE following additions to the story of the Transcons have developed since our article in March QST:

Transcon 14 msg. nr. 3 was reported as terminating at 1DY at 2 a.m. Jan. 15th. 1DY passed the message on to 1MD, Dorchester, a spark coil station by the way, who made the final delivery about 2:10.

We originally reported Transcon 16 reply nr. 1 as being hung up at 1JBT, Dorchester, Mass. So it was, for that "night", but the next morning 1JBT gave it to 1FU, also Dorchester, to QSR, and it seems it did go on to some other station past 1FU.

Transcon 15 Special, from Maxim to Bessey, reported at 6JT at 4:20 a.m. but apparently getting no further. 6AE, Stanford University, Calif., advises us that immediately after 6JT got the message from the east he started it to him (6AE), 6ZK being on 375 at that time. QRM was so bad that it took half an hour to get it OK at 6AE, after which time 6ZK could not be raised and had apparently turned in. So, even if it never reached its scheduled destination it got thru to the west coast and to within 15 miles of 6ZK.

The Washington's Birthday Relay

THE free-for-all relay that was held on February 22d under the management of W. H. Kirwan, Old Man Ex-9XE of Davenport, Iowa, with the co-operation of the A.R.R.L. Operating Department personnel, was a big success in spite of perfectly rotten weather in many parts of the country. It will be remembered that the idea was for every interested amateur, wherever he might live, to pick up the various sections of the message coming thru the air from different parts of the country, piece them together, and deliver to the highest municipal official in his town, get a receipt, and report to Davenport. Some splendid time records were made and concrete evi-

dence afforded once more that Citizen Radio can broadcast information and get it over the entire country in remarkably little time The completed message was from President Warren G. Harding, in an open greeting to the American people, and read as follows:

"May the spirit of Washington be our guide in all national aspirations and may the current year mark the return of tranquility, stability, confidence and progress for the entire year."

A good many hundred dollars' worth of apparatus was donated by our liberal-hearted manufacturers to be awarded to the receiving stations who made the best showing, taking into consideration the distances and difficulties over which the reception had to take place, etc. Our cordial thanks are due Mr. Kirwan for his successful management of the affair; those who have had anything to do with running a relay will appreciate the amount of time, patience, labor, and even money which such effort costs, and for which the sole compensation is the knowledge of having done something constructive for the game we all love. Several hundred amateurs filed their reports with Mr. Kirwan and from them he has prepared a table of performance, showing the percentages achieved out of a theoretical maximum, and from this the judges, Messrs. Edwin H. Armstrong and Hiram Percy Maxim, with Dr. A. N. Goldsmith acting as referee, are choosing the prize winners. The decisions will be announced in an early issue of QST.

The prizes to be awarded, and their donors, are as follows:

A. W. Hallbauer, 1001 N. Lockwood Ave., Chicago, Ill.
1—Pair Lattice Variometers.
Radio Distributing Co., Newark, N. J.
1—Radisco—Vario Coupler.
Clapp-Eastham Co., Cambridge, Mass.
1—Type Z.R.F. Regenerative Receiver.
Chicago Radio Lab., Chicago, Ill.
1—Zenith Regenerator.
Tresco, Davenport, Iowa.
1—Hook'er to Yer Bulb—20,000 meter C. W. tuner.
Eugene T. Turney Lab., Radio Hill, Holmes, N. Y.
1—Spider Web Unit complete.
Coto Coil Co., Providence, R. I.
1—Complete set of Honeycomb Radio Inductance coils.
C. D. Tuska Co., Hartford, Conn.
1—Type 181 Inductance—see their catalog.
1—Type 182 Inductance—see their catalog.
A. H. Grebe & Co., Richmond Hill, N. Y.
1—CR-3A Receiver.
General Radio Co., Cambridge, Mass.
1—One step audion amplifier that sells for $28.00.
Montgomery Ward Co., Chicago and Kansas City.
1—Two step amplifier—this is a beauty, boys.
Signal Elec. Mfg. Co., Menominee, Mich.
1—R37 Tuner—listing at $37.50.
Electrical Specialty Co., Columbus, Ohio.
1—New design Regenerative Receiver—selling for about $50.00.
Federal Telefone & Telegraph Co., Buffalo, N. Y.
1—New type—260 W.—Microfone for Radiofone.
John Firth Co., Inc., New York, N. Y.
1—No. 0-3 Midget Advance Eldrege Meter.
2—No. 0-1 Model H Eldrege Meters, H. W.
2—No. 0-5 Model H Eldrege Meters, H. W.
5—Pairs Brownlie adj. Wireless fones.
C. Brandes, Inc., New York, N. Y.
1—Pair of the new Navy type Wireless fone receivers, 50,000 ohm A/C impedance.
W. J. Murdock Co., Chelsea, Mass.
1—Pair of their well known No. 55 wireless fones, 2,000 ohms.
Sears-Roebuck Co., Chicago, Ill.
1—Large tuner, Navy type.
Illinois Watch Co., Springfield, Ill.
1—Illinois watch.
Shotton Radio Co., Scranton, Pa.
1—Schramco Oscillation Trans. with shielded clips.
Atlantic Radio Co., Boston, Mass.
1—C. E. Antenna Switch.
Klaus Radio Co., Eureka, Ill.
1—of their Radio Storage batteries.
Thordarson Elec. Mfg. Co., Chicago, Ill.
1—Type R/S ¼-KVA Transformer.
Acme Apparatus Co., Cambridge, Mass.
1—Acme 200 Watt C. W. mounted transformer.
Chelsea Radio Co., Chelsea, Mass.
1—No. 3 Condenser with Bakelite Dial.
1—No. 21 Variable Grid Leak.
1—No. 41 Bakelite Dial and Knob.
Connecticut Tel. & Elec. Co., Meriden, Conn.
2—Connecticut Variable Condensers.
Karlowa Radio Co., Rock Island, Ill.
1—C. W. 20 B. Enclosed Rotary Gap.
Wireless Mfg. Co., Canton, Ohio.
Choice of N. S. R. 300 Rotary Gap or N. S. R. 600 Rotary Gap.
The Wilcox Laboratories, Lansing, Mich.
1—No. 14A Rotary Gap.
E. T. Cunningham, Audiotron Mfg. Co., San Francisco, Cal.
1—C-301 Detector.
1—C-301 Amplifier.
Radio Corporation of America, New York.
6—U. V.-200 Radiotrons.
6—U. V.-201 Radiotrons.
QST, Hartford, Conn.
5—Yearly subscriptions.
Radio News, New York.
5—Yearly subscriptions.
Pacific Radio News, San Francisco, Cal.
10—Yearly subscriptions.
Radio Topics, Chicago, Ill.
1—2-Year subscription.
Amrad—American Radio & Research Corp., New York, N. Y.
1—$50.00 coupon for your pick from their catalog of apparatus to this amount.

A Novel Method of Measuring Distributed Capacity

HIGH distributed capacity in coils is to be avoided as it decreases the tuning range considerably and induces high resistance effects at resonant frequency. The last year has seen great improvement in coil design, so that coils with much lower capacity are available to the amateur. Most of the methods of measuring distributed capacity are dependent on the use of complicated formulae, or require precision instruments not ordinarily available to the amateur.

The following is a simple, accurate method of making this measurement, and requires only simple apparatus:

1. Measure, or determine the natural period of the coil. This is best accomplished by using an oscillator.

2. Shunt the coil with a calibrated variable capacity, and adjust until the natural period of wavelength is double.

3. Read the capacity value of the shunt variable.

4. Divide this reading by three to obtain the distributed capacity in microfarads.

Example: The natural period of a coil was found to be 100 meters. The capacity value of the shunt variable to make the natural period 200 meters was .00015 mf. This divided by 3 equals .00005 mf, the distributed capacity of the coil. The explanation of this is that the wavelength varies as the square root of the capacity. Therefore, to double the wavelength, we must increase the capacity four times. Calling the unknown distributed capacity C_1, and the calibrated shunt variable capacity C_2, then

$$C_1 + C_2 = 4C_1$$

Substituting, $C_1 + .00015 = 4C_1$

$$.00015 = 3C_1$$

$$C_1 = \frac{.00015}{3} = .00005 \text{ mt}$$

—Contributed by William F. Diehl, 2CY.

March Station Reports

1HAA, Marion, Mass.

Steadiest	Loudest
1DY—1AW—1GBT	1EAV—1AW—1YB
2RK—2JU—2ZC	2RK—2ZC—2JU
3HJ—3DH—3PU	3HJ—3DH—3PU
4YE—4AT	4YE—4AT
8HP—8ZW—8AMZ	8HJ—8AMZ—8XU
9ZN—9CA—9FN	9ZN—9OC—9CA

1DY, Lynn, Mass.

Steadiest	Loudest
1HAA—1YB	1HAA—1YB
2RK—2JU—2OM	2RK—2JU—2EL
3GO—3DH	3GO—3DH
8XE—8HP	8XE—8ZR

1CK, Braintree, Mass.

Steadiest	Loudest
1HAA—1DAC—1YB	1HAA—1YB—1BM
2RK—2JU—2EL	2RK—2JU—2EL
3DH—3GO—3BG	3GO—3DH—3BG
4BY	4BY
8AGK—8XE—8ZE	8XE—8AGK—8HP
9UH—9JJ—9LQ	9ZN—9UH—9UU

2RK, Brooklyn, N. Y.

Steadiest	Loudest
1HAA—1AW—1OE	1HAA—1AW—1OE
3GO—3HJ—3XF	3GO—3HJ—3XF
4XC—4AG—4BY	4XC—4AG—4BY
5XA—5YH—5ZA	5XA—5YH—5ZA
8ZL—8AIO—8ML	8ZL—8AIO—8ML
9ZN—9ZL—9ZJ	9ZJ—9ZN—9ZL

3BZ, Danville, Va.

Steadiest	Loudest
1AW—1HAA—1GCB	1AW—1HAA—1GCB
2RK—2DA—2JU	2RK—2DA—2JU
3GO—3HJ—3HG	3GO—3HJ—3HG
4YB—4XC—4BY	4XC—4YB—4BY
5DA—5ER—5YH	5DA
8ZE—8ZL—8WY	8ZE—8ZL—8WY
9LQ—9ZJ—9UU	9LQ—9ZJ—9UU

3EM, Baltimore, Md.

Steadiest	Loudest
1AW—1TS—1OE—1GBT	1AW—1HAA—1BBL
2RK—2JU—2TF—2EL	2RK—2JU—2EL
3NB—3DH—3HJ—3GO	
3EN—3ALN	3NB—3DH—3GO
4AC—4AG—4YB	4AG
5DA—5ER—5YH	5DA
8ZL—8XU—8ZW	8ZW
9ZL—9ZN	9ZL

4XC, Atlanta, Ga.

Steadiest	Loudest
Nil	1AW—1HAA—1RAY
2RK—2EL—2BK	2EL—2RK—2BK
3HJ—3DH—3EN	3GO—3EN—3HJ
4AG—4GN—4FD	4BY—4FD—4GN
5YH—5YE—5JD	5YB—5YH—5JD
8ZL—8DC—8ZY	8DC—8HG—8ZL
9AAC—9UH—9UU	9ZJ—9AAC—9YI

4YA, Atlanta, Ga.

Steadiest	Loudest
2RK—2EL	2EL—2RK
3GO—3EN—3YK	3YK—3GO—3EN
4AG—4FD—4GN	4AG—4FD—4GN
5YH—5XA—5IF	5YH—5XA—5HW
8ZL—8DC—8ZL	8ZW—8DC—8ZY
9LQ—9AAC—9LR	9ZJ—9OX—9LQ

7CC, Moscow, Idaho.

Steadiest	Loudest
6ZR—6QR—6EJ	6ZR—6QR—6EJ
9YW	9YW—9WU—9AGN

7ZG, Bear Creek, Mont.

Steadiest	Loudest
5ZA—5XB—5XD	5ZA—5XB—5XD
6ZM—6IG—6ZA	6ZM—6IG—6JT
7YA—7CC—7IN	7YA—7BQ—7CC
8ZR	8ZR
9WU—9YW—9LR	9WU—9YW—9ZN

7BK, Seattle.

Steadiest	Loudest
6EJ—6AK—6OH	6ZR—6EJ—6AK
7CW—7IN—7CC	7BP—7BQ—7IN

8SP, Fairmont, W. Va.

Steadiest	Loudest
1HAA—1AW—1XT	1HAA—1AW—1BBL
2RK—2EL—2JU	2RK—2JU—2EL
3BZ—3EN—3GO	3DH—3GO—3EN
4YB—4FD—4XC	4YB—4XC—4FD
5DA—5YH	5DA—5YH
8ZL—8RQ—8WY	8QJ—8ZL—8FT
9UU—9ZN—9JN	9ZN—9UU—9JN

9DU, Dubuque, Ia.

Steadiest	Loudest
5YH—5LR—5ZA	5BR—5YH—5HL
8ZW—8ZV—8OJ	8ZW—8ZL—8OJ
9YI—9OE—9LR	9YO—9YI—9OE

9AHZ, Kansas City.

Steadiest	Loudest
5YH—5HL—5LO	5HL—5YH—5ZA
8QJ—8TT—8ZL	8QJ—8TT—8ZL
9JN—9OE—9YA	9JN—9OE—9YI

9LR, Anthony, Kansas.

Steadiest	Loudest
2RK—2JU—2ZL	2RK—2ZL—2JU
3DH—3VV—3EN	3DH—3EN—3VV
4XC—4AG—4XB	4XC—4XB—4AG
5ZA—5ZAB—5LR	5XB—5LR—5ZAB
6IG—6JD—6ZN	6IG—6JD—6ZH
7ZG—7KX—7YA	7ZG—7KX—7EX
8ZY—8ID—8ZL	8ZY—8ZL—8KP
9AEG—9EQ—9WU	9YI—9ZJ—9LA

9YB, Lafayette Ind.

Most Consistent	Loudest
None	2RK
3DH—3YK	3DH—3NB—3YK
	4YB—4AL—4DJ

5YH—5DA—5YE	5DA—5YH—5YE
8ZY—8ZA—8ZD	8ZY—8ZR—8ZA
9ZJ—9LQ—9QO	9ZJ—9ZQ—9LQ

Remarks:

First District. No change. Few stations heard.

Second District. 2RK much best, no others are good.

Third District. 3DH still in lead. 3NB very QSA once or twice. A newcomer 3YK with a peculiar tone seems to work through all kinds of QRM and QRN.

Fourth District. All stations seem to have dropped off from the earth. Only a few stations heard and very irregularly.

Fifth District. Same stations doing the work. 5DA roars in like a local station.

Sixth and Seventh Districts. No stations heard.

Eighth District. Toss up between many good stations. 8ZY seems to have a slight lead this month with 8ZA, 8ZD, 8ZR and 8XE pressing closely for the honors.

Ninth District. 9ZJ still the station heard loudest but is not working very often. 9LQ still the station heard most often of any in the call book. 9OE and 9QO among the regulars and 9YA, 9YW, 9YY, 9ZC and 9ZQ among the specials seem to be in the air regularly.

The Resonant Converter

By Walter S. Lemmon

Presented before the Radio Club of America, Columbia University, Nov. 26, 1920.

THE many advantages accruing from the use of high musical tones in radio transmitters of both spark and C.W. types has led to the development of a simple and effective means of producing them.

The Resonant Converter is applicable in its present development to both types of apparatus and therefore may be particularly interesting to amateurs at this time. Before describing the device in detail it may be well to state that it has been used by the writer for many years during its development, both at his own amateur station and at others'.

No attempt will be made in this paper to outline the complete development of the device but some of the fundamental features will be given of the practical apparatus already produced. Essentially the Resonant Converter was developed as a simple means of converting direct current into alternating current of any desired frequency. In practice this alternating current may be applied in the transformer of a spark set or to the plates of vacuum tubes.

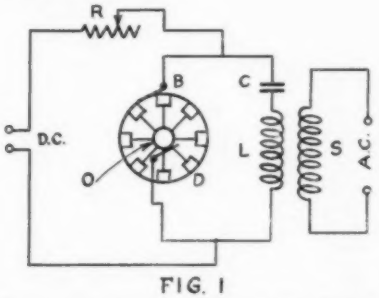


FIG. 1

The component parts of the fundamental circuit are illustrated in Fig. 1. Here D represents a revolving disc or controller containing alternate conducting and insulating segments which for the purpose of illustration may be assumed of equal length. A brush B and a collector ring O lead the current through the disc. The disc controls the admission of energy from the D. C. source to the resonant circuit LC. The speed of the disc is adjusted so that the number of makes or breaks per second is equal to the natural frequency of LC. (a complete cycle being produced by a complete make or break.) In order to control the energy admitted to the device and also prevent short circuiting the line, a control resistance R is inserted in the supply lead. Inasmuch as R is non-inductive it does not alter the tuning conditions of the resonant circuit.

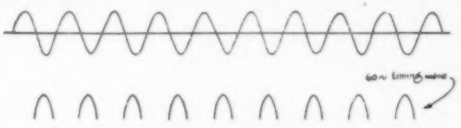


FIG. 2 - RESONANT CONVERTER - OUTPUT CURRENT WAVE SHAPE OUTPUT AT RESONANT SPEED

The wave shape of the current produced by the machine when operating at resonance is shown in the oscillogram, Fig 2. This oscillogram was taken with the machine adjusted to give 60 cycles and it will be noted that the wave shape is remarkably sinusoidal. With resonant adjustment any sparking at the controller practically disappears. This adjustment, moreover, is not critical but the driving motor speed can be varied over quite a range before sparking becomes objectionable. While not attempting to dwell too much on theory in this paper, the action of the Resonant Converter may be roughly described as follows: During the period of break, the resonant circuit is charged from the supply line and then during the closing of this contact the energy in LC is discharged at the same time period. The current upon discharge acts oppositely to the line current so that the break is accomplished at a point of minimum current flow

—hence no sparking. Due to the opposite direction of charge and discharge, and the regular repetition of this action, an alternating potential of pure wave shape is produced at the terminals of the transformer.

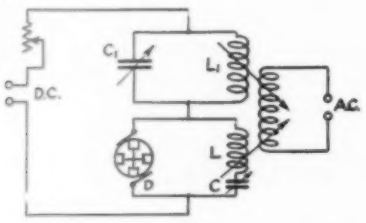


FIG. 3

If instead of supplying the resonant converter with direct current, an alternating current is employed, it is possible to multiply the frequency of the source. For instance, from 60 cycles a 500 cycle tone may be obtained. This effect will be treated more fully later in the paper.

Now instead of using the resistance, R of Fig. 1, to control the power supplied, an effective resistance may be composed of the parallel inductance and capacity L_1C_1 as in Fig. 3. When this circuit is tuned in a similar manner to LC it has the current limiting effect of a resistance,

FIG. 4—RESONANT CONVERTER—OUTPUT CURRENT ABOVE RESONANT SPEED RANGE

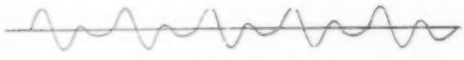


FIG. 5—RESONANT CONVERTER—OUTPUT CURRENT BELOW RESONANT SPEED RANGE

without seriously altering the other operating qualities of the machine. As a further refinement it was found that there was a circulating current in the parallel circuit, L_1C_1. Therefore this circuit could be coupled to LC, thereby amplifying the output by a sort of regenerative action. In some experiments it was found that this amplification increased the output about 20%.

It may be interesting at this point to note that when the machine is operated above or below synchronous or resonant speed, we no longer have a sine wave output but the distorted waves of Fig. 4 and 5 respectively. When the Resonant Converter is operated from an A.C. source the resulting spark note is not exactly a pure tone but carries a 60 cycle undertone, which however gives a resultant tone readily distinguishable through static. By adjustment of the various circuits, however, the quality of the musical tone can be varied at will, and with certain refinements the lower frequency can be eliminated.

The Resonant Converter as a spark transmitter is shown in Fig. 6. Here the primary of the transformer is formed by the inductance L inserted in the resonant circuit. The condenser C is made variable in steps, which for low power transmitters may be several 2 mfd. telephone condensers (tested for 1000 volts.) The resonant control circuit L_1C_1 may be formed of a similar set of condensers, and L_1 made either a part of the primary winding or a separate inductance. A small resistance R is inserted in the supply lead to vary the power.

While the transmitter will operate very satisfactorily with a quenched gap, it is

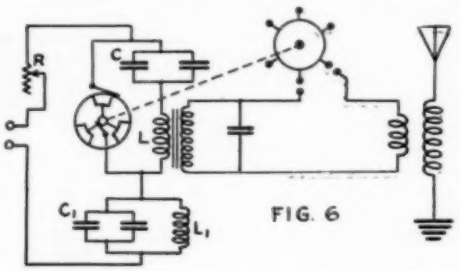


FIG. 6

ideally suited for the use of a synchronous gap. The synchronous gap is mounted directly on the driving motor shaft and since the position of maximum voltage is readily found the gap functions very smoothly. Inasmuch as the resonant converter gives one alternation at make and another at break, the gap should contain a number of studs equal to twice the number of conducting segments on the controller disc.

A photograph of a model transmitter

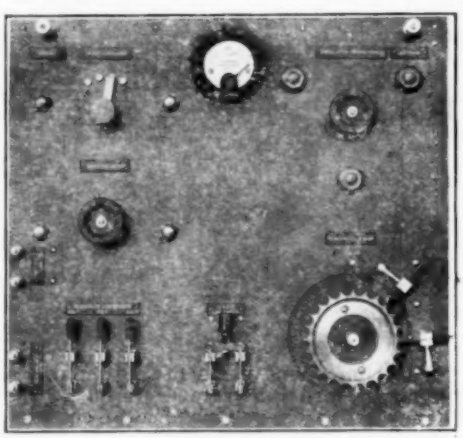


Fig. 7

built along these lines is shown in Fig. 7. The set is designed for 200 watts and is of the panel type. A pure musical spark tone can be obtained at any desired frequency from 300 to 500 cycles. The set operates from 110 volt D.C. and is simple and easy to operate, requiring but few adjustments.

Among the various applications of the Resonant Converter principle, perhaps the most interesting one at this time is that of a plate voltage generator for V.T. sets. Its inexpensive contruction and steady operation makes it particularly desirable for amateur low power work where a 500 cycle alternator or high voltage D.C. generator is not readily obtainable. Since the Resonant Converter gives a pure tone readily adjustable from 200 to 500 cycles it may be directly employed for modulated C.W. telegraphy or used with a suitable filter for telephony.

In Fig. 8 the use of the Resonant Converter is illustrated, together with a double self-rectifying circuit. The converter produces directly at its terminals 1000 volts at a frequency adjustable from 200 and 500 cycles. Taps may be provided on the transformer secondary to obtain other voltages for tube operation. In case only one tube is used the entire output of the transformer may be directly applied to its plate.

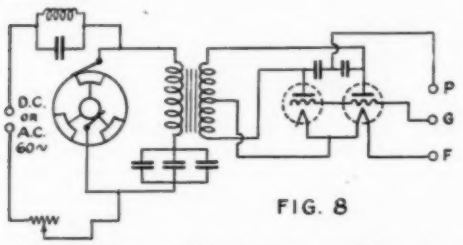


FIG. 8

Using the model shown in Fig. 9 a plate voltage of approximately 800 volts and a space current of 120 mils has been obtained from a 100 volt D.C. supply. This has been found sufficient to operate several 5 watt tubes in parallel. By using an A.C. supply and an A.C. driving motor (preferably synchronous) a clear tone closely resembling the old "Cape Cod" note can be produced. This tone has excellent carrying properties made famous by old "WCC" in the days of long distance spark press. When using the Resonant Converter on A.C. cycle supply, the tube filamaents may be lighted from the supply line by

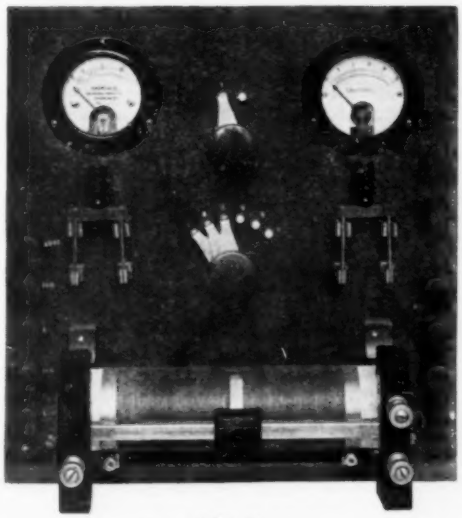


Fig. 9

a small transformer. There are of course many other arrangements of the Resonant Converter circuits of which space does not permit the description.

In conclusion, it is believed that the development of the Armstrong superheterodyne receiver will work hand in hand with a device such as the Resonant Converter for vacuum tube transmitters. This receiver of high amplification reproduces the exact tone of the distant transmitter and the great value of a distinctive tone is not lost by heterodyning. In traffic work over congested areas, which is the case with amateur or short range ship operation, constant and easily distinguishable tones are a great advantage. It is here that the adjustable frequency and wave-shape of the Resonant Converter may be found of greatest value.

C. W. for the Amateur

By Franklin S. Huddy, 1II

THERE is no doubt that C.W. is the coming thing in the amateur world. It fills every need as regards the law, and, when considered as a whole, is a great deal cheaper and more satisfactory than the spark system. The number of C.W. stations going at this time is truly amazing, and the work that they do is even more so. Thanks to a well known concern, a very practical little power tube has been put on the market at a very low price. This is the greatest boost that amateur C.W. has had for a long while. The thought of paying some hundreds of dollars for a high power tube has kept many away from this new art.

When you have mentally digested the above, and are convinced that it is true, you will want a C.W. set, let us hope. Then you think of the maze of complicated hook-ups and the quantities of apparatus that you must have, and it seems hopeless. I think that the following will help make matters clear. There are several hook-ups adapted to every kind of situation. Surely one of them will be right for you.

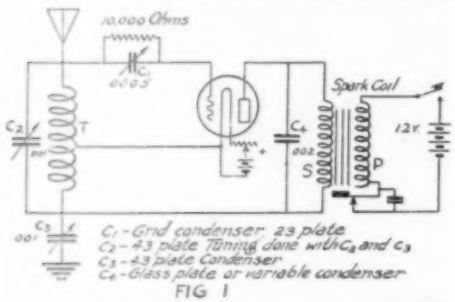


FIG 1

Here is scheme number one. It is I.C.W. and cannot be used for phone work. The source of high potential is our old friend the time-honored "squeak-box." This little system works very well indeed and is worth trying, (Fig. 1). The inductance is made as follows: Twenty five turns of insulated wire of any size between 12 and 20. B. & S. wound on a tube 5¼ inches in diameter. Such a tube may be obtained from a package of "Quaker White Rolled Oats." The tap "T" is at the 16th turn from the bottom.

The circuit in Fig. 1 is a very good oscillator for use on a small antenna. Even with a fairly large one, a 200 meter wave may be obtained with C_3. If a source of D.C. is used for the filament, it should be

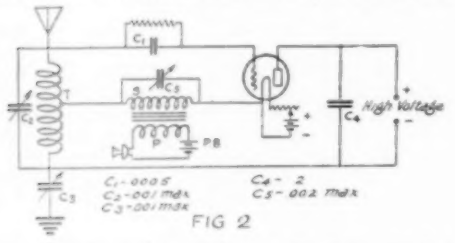


FIG 2

connected as shown, but A.C. from a step-down transformer may be used with equally good results. A set like this using one Radiotron UV202 on a good antenna will put into the antenna 500 M.A.'s or higher if the tube be "crowded" a little. The grid leak is very important and **must** be carefully adjusted. A resistance of around 10,000 ohms is correct, altho it varies with every tube.

Scheme number two. Figure 2 shows the same circuit used as a phone. The constants are the same as in Fig. 1. In this circuit a D.C. must be used on the filament for best results. The battery "PB" will vary according to the type of transmitter used, but a regular Western Electric transmitter takes about 18 volts.

There is no need of buying an expensive modulation transformer. A Ford coil is very nearly as good in this circuit as any on the market and is preferable for two reasons. First; there is a very high voltage-amplification which is necessary in this circuit or in any circuit employing grid modulation. Secondly; the low resistance primary permits use of a smaller microphone battery with consequent lessened heating. The vibrator should be firmly short-circuited. The condenser across the secondary must be of at least .002.

Scheme number three. Figure 3 shows a circuit for a more advanced radio-phone. It is very stable, easy to adjust and very efficient. The inductance "L_1" is wound on a tube 5¼ inches in diameter: 60 turns of number 14 D C.C. magnet wire tapped

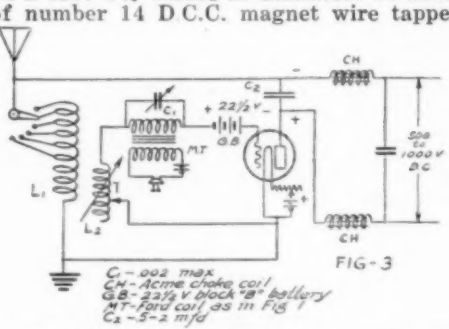


FIG-3

every fifth turn for thirty turns. The coil should be impregnated with a good insulating varnish, and, if possible, baked to exclude any trace of moisture. Tickler "T" is of 50 turns No. 18, tube 5 inches in diameter, tapped every 5 turns, and slips inside of "L_1".

Altho these sets are very simple, real results may be had from them, and the writer hopes they will be of help to other amateurs in getting a C.W. set on the air.

The Chicago Plan*

By R. H. G. Mathews, Central Division Manager

The admirable organization of the Chicago District is becoming known the country over and the plan has been applied with success in many other communities. In this paper Mr. Mathews describes the system in detail in a manner that wll serve as a guide to its inauguration elsewhere. We commend these principles to A.R.R.L. men everywhere.—Editor.

IN a large city the population is always divided into sectional groups, each comprising individuals of differing racial characteristics, habits and inclinations. Even though America is a "melting pot," its heat is not always sufficient to blend together in one harmonious mixture the acid, oil and water of the temperaments of the various nationalities comprising the population of our large cities.

Single large radio clubs have always signally failed to secure perfect cooperation between the various groups and cliques of radio men found in our large communities, partly for the reason just mentioned, and partly because of perfectly natural sectional rivalry. If properly directed, this rivalry can become helpful and constructive competition.

In Chicago before the war several attempts were made to consolidate the several conflicting groups, which, because of local conditions resolved themselves into north, south and west side "gangs," each having as a primary object the annihilation of the aerials of the others. Frankly, Chicago conditions before the war were the worst that the writer has ever seen anywhere. We can recall vividly the time when old 9IK was to participate in one of Kirwan's Washington's Birthday Relays and the entire aerial was forcibly and thoroughly removed thirty minutes before the scheduled time. Another antenna was hurriedly built which srved the purpose and the relay went through but in order to keep this one from following the first, two friends sat out under the mast with 38 calibre "cannons," and chased away exactly eight individuals, each with his little side-cutting pliers.

If this condition had continued Chicago would have been the dead spot in regard to relay traffic that several other large cities are at the present time. Fortunately, however, there were in each of the already existing sectional "clubs" certain individuals having influence and with an unselfish consideration for the radio game as a whole. The writer and Mr. F. H. Schnell, then Chicago City Manager, called together these men and the Chicago situation was discussed. As a result, the method of organization now known as the "Chicago Plan" was evolved.

By this plan Chicago radio matters are regulated and administered by an Executive Radio Council composed of the officers of each club affiliated with the council. All such clubs must be already affiliated with the A.R.R.L. before application for affiliation with the Chicago Executive Council is considered. At the present time the clubs comprising the Council consist of five in the city of Chicago, one in Indiana just south of Chicago, one in Elmhurst, just west of Chicago, and one in Milwaukee, north of Chicago. As each club becomes affiliated its officers automatically become members of the council which is presided over by the Chicago City Manager, appointed by the Central Division Manager. An elected chairman of the council is not desirable since better cooperation with the League is secured by making this office one of appointment rather than election.

In order to control interference it has been found desirable not only to admit already existing clubs but in cases where there is territory where no clubs exist, but because of the number of radiomen in such territories the need of a radio club is felt, the Council of its own volition sends out organizers for the purpose of forming an organization which will be affiliated with the council in due course.

Being composed of elected officers from all parts of the city, the Chicago council is a really representative body and this fact has added to the respect with which it is regarded by Chicago radio men. Traffic regulations adopted by such a body must of necessity be fair to all interests and accordingly little trouble is found in enforcing such rulings. No attempt is made by the Council to interfere in any way with the individual activities of the various affiliated clubs but the best of cooperation between them is secured through the friendly personal contact of the officers. Through regulation the dues and fees of all clubs are the same. Any radio man may belong to one or more of the clubs as desired, and meeting dates are arranged so that they do not conflict. The average active membership of each of the Chicago clubs is approximately 100,

*A paper presented before the Third District Convention at Philadelphia, Feb. 26, 1921.

making a total active membership for the city of 500. In order to keep this great number of men interested, the clubs pay considerable attention to the social and fraternal side of club life. We have found that in a radio club paying attention to technical matters only, the interest soon dies in the great mass of members and accordingly the Chicago clubs run raffles, dances, theater parties, etc., and have baseball, football and basketball teams, competing with each other under the guidance of the Executive Council. All our efforts have been toward creating better friendly feeling and cooperation among the mass of Chicago radio men. In order to gain their cooperation we must have their active memberships in the various clubs and to get this we must make the clubs so attractive that membership is a privilege rather than a duty. On this rests the structure of our Executive Council. Without the firm foundation of willing and interested cooperation with the individual clubs an Executive Council is without prestige and authority.

After all, the biggest moral force in the world is that of public opinion, and on this fact the Chicago Plan is based. In order to maintain this prestige, club members will not carry on radio communication with outsiders and every effort is made on the part of club officers to set forth the advantages of membership to newcomers in the radio game. Individual attention is given every radio man who is not a club member and as a result there are no "outlaws" in Chicago.

A set of traffic regulations has been drawn up by the Council as follows:

Sec. 1. There shall be four divisions of operating hours as follows: 6 a.m. to 7 p.m ; 7 p.m. to 10 p.m ; 10 p.m. to 11:30 p m.; 11:30 p.m. to 6 a.m.

Sec. 2. Between the hours of 6.a.m. and 7 p.m. stations may test, tune, transmit either locally or long distance without interruption.

Sec. 3. Between the hours of 7 p.m. and 10 p m. stations may transmit **locally only.**

Sec. 4. Between the hours of 10 and 11:30 p.m. transmission can be made only to long distance stations. Stations not having regular traffic to clear should use this period. Those working between these hours cannot during the next period; see section 5.

Sec. 5. Between the hours of 11:30 p.m. and 6 a.m. transmission can be made only to long distance stations. Those having worked during the previous long distance period (Sec. 4) cannot transmit during this division.

Sec. 6. All stations within the jurisdiction of the Council shall use the minimum amount of power necessary to carry on their communication.

Sec. 7. All official Traffic Officers may communicate with each other at any time to assist in carrying out their work. They should be brief.

Sec. 8. At no time shall any unauthorized person assume the duties of a Traffic Officer unless given such authority by the City Manager.

Sec. 9. Stations commencing operation after any extended absence shall be permitted, after asking "QRW?" to call "CQ" three times followed by his call three times in order to ascertain whether any long-distance is waiting for him. The abbreviation "QRU?" may also be used.

Sec. 10. All radiophones and CW sets are considered as radio transmitters and come under these regulations at all times.

Sec. 11. All stations desiring QSP tests will use the following form only: Call the station once, signal QSP, sign own call once.

Sec. 12. All stations within the jurisdiction of the Council shall be considered as local to each other.

Sec. 13. Any irregularities of the above regulations shall be promptly reported to the local Traffic Manager who will report same to the City Manager so that action can be taken on each side, thereby stopping the trouble at once.

Sec. 14. The Traffic Officers shall be the only ones permitted to send out local "QST's" for the City of Chicago.

Sec. 15. Traffic Officers shall use the personal sign "TO"; their assistants, "TR."

Note:— No station should dispute an order given him by a Traffic Officer, over the radio. If there is any misunderstanding or question, use the wire telephone or make your written report to the City Manager.

It will be noted that the evening is divided into three periods, one for local and two for long distance work. Originally it was thought that there were but two classes of radio amateurs, local and long distance, but a trial showed that there is a third class of operators doing long distance work but not interested in mes-

sage traffic. These operators wished to carry on conversations, test their sets and experiment and resented the "hogging" of the air for long periods by the stations handling message work. I believe this fact is the rock on which many a good set of traffic regulations has split up. By establishing **two** long periods, the first for work other than traffic and the second for traffic only, and providing that no station may work **both** periods but may choose which he prefers on any one night, all friction between traffic men and experimenters is eliminated.

The Chicago traffic regulations are enforced by the City Manager and a corps of assistants. These assistants are elected, three by each club, to stand watch in order, and each one has authority over members of his own club only. However, a log of **all** violators is kept by each traffic officers and these logs are turned over to the City Manager weekly. The City Manager separates these violations and turns them over to the proper club, also weekly. The officers of the clubs investigate each case and decide whether the violation was caused by ignorance, malicious action, etc., and report to this effect on every case to the City Manager. The City Manager, in turn, presents these cases, as soon as reported back, to the Executive Council which places a fine for each offense, not on the offender **but on the club to which he belongs**, or, if he is not a club member, on the club in whose territory he is located. It is then up to the club to collect the fine from the individual if it can, and to see to it that further violations do not occur. In this way the Council has an organization to hold responsible for every violation and in addition, since the fines come out of the club treasuries, every club member feels a very personal interest in the violators, since the theater parties, etc., can only be run when there is money in the treasuries to run them. If 99 men feel that one other man is keeping them from having a good time by his persistent "ignorance" they are certainly going to assist personally in his rapid and forcible education. Another example of the force of public opinion properly harnessed and applied.

As a matter of fact, this plan has worked so well that very few fines have been necessary. Cards are mailed by the Traffic Officers to each violator when the violation is logged, these cards naming date, time and nature of the violation and requesting the violator to get in touch with his club president at once regrding the violation. This prevents the violator from protesting that he was never given notice of his wrong action and "knew nothing about it," and also has an excellent psychological effect. I have known of instances when all the traffic men were on the job and each violator received 15 cards on the subject.

Traffic officers never argue over the air. If a violation occurs within the territory of any traffic officer, he calls the violator by radio, and merely states that he has violated a certain rule, naming it, and asks him to stop. If the violator is disposed to argue, the traffic man does not reply by radio but calls him by telephone at once. A complete list of all Chicago calls is furnished the traffic officers by the local Radio Inspector as fast as they are issued and these calls are listed with phone numbers by each Traffic Officer. Calling by phone also has a good effect in that the ringing of the phone generally wakes the violator's family and he gets a paternal "razzing" in addition to the one administered by the traffic man.

Seriously, however, the traffic officers are required to be very careful and diplomatic in their work and every attempt is made to secure the cooperation of persistent offendrs by friendly methods and these usually win out.

In addition to the Traffic Officers, the Council has a "direction finder squad" supplied with a car, equipped with a loop, regenerative receiver and three-step amplifier.

This squad exists for the purpose of locating unlicensed or "mysterious" stations and cooperates with the radio inspector in every possible way.

The Chicago traffic rules are very carefully observed by all traffic men and can only be set aside by direct order of the City Manager or the Central Division Manager for some special reason of extreme importance. In this way criticism of the various traffic officers is avoided.

Our attempt has been, first, to draw up rules fair to the little fellow as well as the big one, and to have these rules drawn up in such a way and by such a representative body that the little fellow **knows** they are fair; second, to administer these regulations in an absolutely fair and straightforward manner, and in such a way that everyone **knows** the administration is fair; and, third, to secure compliance with the regulations by tactics of friendly cooperation and the force of public opinion rather than by individual threats or action. These methods combined with the loyal mutual cooperation of our big fraternal radio "club-families" have converted Chicago from a radio-Bolshevist community to what I now believe it to be, the best big radio city in the United States, and to prove this I ask you to note how few repeats Chicago long distance stations request because of "local QRM."

The CQ Hound

By 7KX

HERE is an epistle that I have been trying to get off my heaving chest for the past thousand years. Who is not familiar with the CQ hound? I can not think of what specie to call him, maybe a Dachshund, as he sure is longer one way than the other when it comes to polluting the sacred ether with his long pleading wails for some other ham which he hopes to be at least fifty thousand miles away to come back at him "vy QSA OM". I am stuck away out here amid coyotes, cowpunchers and sage brush, not all because I want to be but because my nose led me here. Then being a pre-war ham I had to put up a set to listen to the quality of the post-war sigs. Oh man, it sounded good to hear the old gang again and all went well until the newness of the game wore off again and I settled down to do some real receiving. Then it was that the CQ hound began to burn my ears like the hot solder burnt my face when I was trying to solder the aerial to the sky hooks. Men, I have stood it as long as I can and now to relieve some smouldering gun play that is sure to come off I must hasten this rattle eastward to the QST factory.

When it reaches the aforementioned place it will probably find its rightful place, the waste basket, but if it ever gets into print among the sacred pages of our good old QST let some of the newer of our set soak it in. Then when they go to bed that night let them ponder over it a while and before the sand man puts their lights out for the night, swear that they will never holler CQ again, and if the temptation is so awfully great, not to squeal it more than three times and then sign off and QUIT.

The climax came the night of the Washington's Birthday Relay (in capitals, men, as it made history) and as my chest was heaving so high that night as to break over the sea wall, I couldn't refrain any longer. I put the fones on at 6:10 P.M. M.T., the time here that the msg was to start from our far famed 1AW, the start of the Eastern half. That these CQ hounds were on the job was at once noticeable. I didn't lay the fones on the table until 10:22 P.M. when I received the complete msg, and during that time I added the blackest page to my call book that the history of my radio play has ever brought forth. If I could put that page into print many of the CQ-slinging hams would see their calls listed as outlaws in the amateur game. Two stations who are in the state where many good amateurs reside, the state where the Dalton Bros. robbed the coffee store, the state where the sun-flowers wither in the hot sun in the summer time, are among the most prominent of the black page outlaws. They kept the ether so fluttered up with QRM that any non-suspecting novice who might have happened to be listening in with the "Town Ham" couldn't help but say "who is that making all that noise?" During the time that one of our good stations in this same state was doing all his Benwood and Dubilier would do for him, trying to get the first words of the west half of the msg to the Windy City, these other birds were chirping off at "bug" speed, jamming all who were straining every nerve in their bean to get the first whimper of the west half of the msg. One of these stations was listed in a recent issue of QST as reaching out and he is, but why in the name of amateur radio does his call have to clutter up my black list as a bad actor? I am out here on what you might call the jumping off place as traffic here at times bumps up against a wall of QSS till working is nil. I have only one bulb but, man, it gets more CQ's into my fones than it does intelligent sigs. My sympathy goes out to the fellows that live right among the CQ hollering, the "legislation agitating" hams, and if we could peek into the radio shack of some of these old timers we would certainly find a book lying around handy in which there would be at least one black page. A lot of us could cast our glimmers over that page and find our calls listed there with the rest of the outlaws of amateur radio.

We talk about the so-called little fellow with the spark coil, we have sworn at him, put him in print as the real outlaw of the radio game and have branded him with the skull and cross bones. But mark my word, these "little" fellows will have a seat in the place we all want to go to and there won't be one single CQ hound there to bother him with their plea "how do you receive me?" I have heard a few of our good stations crying CQ but always followed with east, west, north or south msg. letting us know he has a msg. for some one in that direction. Here is where the CQ helps our game, but the bird that hollers it to see how many cards or letters he can get is the one this trash is directed at.

We hear you, CQ hounds. Open your dreamy eyes and look at the calls heard in QST and see how far you are getting, but on bended knees, CQ hounds, please put that call where the Allies put the

(*Concluded on page 28*)

EDITORIALS
de AMERICAN RADIO RELAY LEAGUE

Another Poindexter Bill.

ON Tuesday, April 12th Senator Poindexter reintroduced his radio bill in the new Senate and it now has a new number—S-31. At this writing our Legislative Committee has not yet secured a copy of the bill to examine it but it is suspected that it is the same document that was before the last Congress under the number S-4038. Newspaper clippings just before us today indicate that still another bill has been introduced in the House, by Representative White of Maine, and it seems that it must follow somewhat the same lines as Senator Poindexter's bill except that the committee of representatives of various radio interests is to be an advisory body in Representative White's bill, whereas S-4038 would have empowered it with the formation of all the technical regulations governing radio in this country.

Eternal vigilance seems to be the price of safety in any field where there are so many different interests, more especially in such a one as ours. It looks, fellows, as tho if it isn't one radio bill it's another! These bills have just been introduced and as yet we don't know what they are, but if Mr. Poindexter's is the same as his 4038 it must be opposed. Certain interests in the east who would seem to have something to gain by the passage of such a bill have recently given much publicity to a letter signed by the then acting secretary of the Navy stating that it will be the policy of his department to further in every way practicable the interests of the amateurs and that the Navy will advocate the freest practicable development of amateur activity. We earnestly hope for the establishment of cordial relations with the Navy Department, yet Senator Poindexter's S-4038 was patterned on a draft gotten up by naval officials and it was *not* the kind of a bill we could support, for it would give control of all radio into the hands of a committee over which the navy would have the balance of power and would give no assurances of fair dealing with us amateurs. The Navy Department and Senator Poindexter must realize that American Citizen Radio will not be content with legislation that, instead of definitely allotting certain fields to amateur work, arbitrarily gives over its destiny to the hands of "a little group of willful men" who are answerable to nobody and from whose decisions there can be no appeal.

Use Your Wave Meter!

WAKE up, fellows, and find out what your wave length is! Buy or borrow a wave meter and take some readings, and if she reads above 200, by the Lord Harry cut 'er down!

We are insistent on this subject the last few months because we know there is sure trouble ahead if the situation isn't remedied. There are thousands upon thousands more amaturs than ever before in the history of the art and the chances for infringing upon the rights of other interests when we begin to overstep our bounds are just that much greater. The other night we heard three naval stations pipe down four different amateurs for QRM. No doubt part of this trouble was due to the way the average naval operator tunes a set, but it is likewise probable that the amateurs in question exceeded the legal 200 meters or they would not have been the only ones picked upon. All this stuff gets written down in government logs, you know, and when there becomes too much of it, thru our ever-increasing numbers, the fur will surely fly. If you get your license revoked because you operate above 200 meters will you expect the A.R.R.L. to help you? N.D., O.M.—we can't support a violator of the law. You're having your chance right now—mark our words: it will pay you to stop operating until you get your station in conformity with its license as regards decrement, power, and more particularly wave length.

Help us in "the return to normalcy"—USE your wave meter! In turn we're going to help *you*. Our Operating Department is appointing listening-in stations who are going to give the Traffic Manager lists of stations heard on waves above 200. Those of you who are reported are going to get a nice letter telling you just what your wave is and asking you to help preserve Amateur Radio by getting down where you belong. Of course this will be

a strictly intra-organization matter, and its sole object is to help us better ourselves. Saw off work long enough to retune that station of yours so a report on you won't be coming in here to Headquarters.

Our Bonds.

AS we write this our Treasurer's office is busy making out checks and our Secretary's office is busy making out envelopes to mail those checks, to reimburse the good amateurs who two years ago lent their A.R.R.L. the hard coin to purchase QST and resume the publication of the little magazine we all love so much.

Our bank balance when we get thru is going to be as low as a sixty-cycle growl, but just the same we're going to do it. We'll be cramped financially for quite a while, as it's taking every penny we can rake and scrape, but the bonds *shall* be paid, and *will* be by the time this QST is mailed. And we'll get by, and gradually as we accumulate a little reserve we'll be freer to undertake new work.

One of the things we want to do first is to publish a real textbook on radio; a book different from any other now in existence, dealing with the basic theory of amateur radio in a way that will give every amateur operator a clear theoretical understanding of how his apparatus functions so that he may experiment intelligently and not haphazardly; and a book that will likewise serve as a text for the non-technically trained individuals who in increasing numbers are taking up the study of Citizen Wireless.

The CQ Party

SOMETIME in listening in on a particularly good night it has seemed to us as if all the amateurs of the country were transmitting at once. But now we know we were wrong. In the CQ Party only one district transmitted at a time, but man, dear, did you ever hear anything like it? Such QRMMM surely was never heard before and we hope it never will be again. We suppose O.M. Baldwin will be busy the next two years replacing cracked micas from that one half-hour's foolishness.

The party seems to have been enjoyed universally, and there were almost as many "Hi's" floating around as there were "CQ's", showing that most of the gang appreciated the spirit of the thing. Lots of new records undoubtedly were made. 9ZN, we know, copied a flock of 4's that never had been heard there before; and so it went. A number of Canadians were heard all over the eastern and central states. 9ZN sent out its first and last CQ that evening. 8KK wins the handsome single-slide tuner for having crammed more CQ's into his three minutes than anyone else, ripping them out at lightning speed with a bug key. But wouldn't it have been wonderful if all of these birds had stayed on schedule? Why did a few stations have to work clear thru the party? Don't they ever read QST? (But, say, gang, can you imagine the sensations of the benighted brethren who hadn't read QST and who all by chance got an earful of our party? They must have thought it unwontedly queer that so many stations were simultaneously indicating their willingness to chew the rag with anybody so inclined!)

But the CQ Party wasn't intended altogether for diversion. It had a serious purpose—to show up the foolishness of the unholy amount of CQ-ing that has gone on every night all over the country, causing untold interference that is so unnecessary. Persistent CQ-ing is nothing less than a bad habit, accomplishes nothing good whatever, and merely breaks up communication in nearby states. Relay stations know with whom they are supposed to work in handling traffic without having to sear the heavens with a CQ in order to pick up enough business to get fun out of the game. We refer, of course, to operation in DX relay hours; if during "conversation" hours one wants to CQ, it's excusable if he doesn't know a soul to call by call-letters. But for the love of Mhy. let's keep CQ out of relay hours.

THE CQ HOUND

(*Concluded from page 26*)

Kaiser. I beg you to do this, and "I" means the whole A.R.R.L. and if you satisfy my wondering whims by doing so you will satisfy about as many other hams as you have hair on your old CQ hollering pate. I have a sneaking idea that this will start a rumpus that will be harder to stop than it was to stop Daniels from trying to get our game under the old sea dogs, but I have it off my chest and am ready, bulb lit, fones on and aerial switch in, ready for all the nice language you want to throw at me. If you can't get at this QRM problem by pleading like good men do we will have to hit you with a little hot stuff and then see if you can pipe down for at least a couple of hours in the night. I am out here where I can take to the mountains if you come after me but remember I will take a portable set with me and after your attack has subsided I will come back at you with a CQ story that will burn worse than this one.

So-long, CQ hounds, never to CUL.

The Operating Department

F. H. SCHNELL, Traffic Manager
1045 Main St., Hartford, Conn.

IN spite of the coming of QRN our reported messages reached a total of 8840 for the month of March.

The New England Division lays claim to the individual honor position this month when "Amateur Number One" rushes to the front with this report:

MR. I. VERMILYA, 1HAA
Marion, Mass.
608 messages.
New England Division

This is the greatest number of messages yet credited to a single station in any one month, and we congratulate Mr. Vermilya, not only for his remarkable piece of work, but also for *reporting* it in time. Many of our members handle more than a hundred messages each month but fail to report them. Help your division, fellows, and send in a report of your work on time.

Southern Stations.

Our persistent efforts to work thru to Florida have borne fruit. Traffic is now moving from 4YA, Atlanta, to 4FD in Midville, Ga., and 4BY in Savannah, Ga. These stations QSR to 4DL, 4AM, and 4BI. While this route is only fairly consistent, improvements will be made. QRN in that part of the country is the greatest handicap with which southern amateurs have to contend right now.

C.W.

Perhaps the scarcity in reports this month is due to the fact that many spark stations are being dismantled in favor of the onrushing C.W.—our members are too busy making the change to spare the time for writing reports. We hope this assumption is true, as next month we will be in the midst of the QRN season and C.W. will be our only means of reliable communication over great distances. C.W. station owners are requested to communicate with their Division Managers for appointments on the C.W. routes which will be in operation next fall. We want C.W. transcontinental routes open for traffic just as soon as stations are available.

Reports this month are missing from the following divisions: Delta, J. M. Clayton, Mgr.; Central, R. H. G. Mathews, Mgr.; Rocky Mountain, M. S. Andelin, Mgr.; and St. Lawrence, A. J. Lorimer, Mgr. The other reports follow:

CENTRAL DIVISION.
Ralph Mathews, Mgr.

No detailed report received.

Total messages 1710. Busiest station, 9YAD—143 messages.

ATLANTIC DIVISION.
C. H. Stewart, Mgr.

Just at the present time this Division is undergoing a state of reorganization, with the result that reports are lacking. It is hoped that the changes recently made in personnel will result in improved conditions in the future, both as regards monthly reports and other traffic matters.

Mr. John DiBlasi, owing to pressure of his own business matters, has resigned as A.D.M. Northern Section, and the Division was fortunate in finding a successor who we have every reason to believe will make good as soon as he has had time to acquaint himself with the traffic affairs of the Northern Section. Mr. Clifford J. Goette, (2JU), 1624 Hamilton Avenue, Woodhaven, L. I., N. Y., has been appointed A.D.M. for the Northern Section, which comprises the States of New York and New Jersey. As Mr. Goette's appointment was only made on the 18th of March it was obviously impossible for him to acquaint himself with the affairs of the Section in time to make a report this month, but we will expect a good report from him for the coming month. There are some remarkably good stations in this Section and there is no reason why with proper co-operation the best of operating results should not be achieved, and the Division Manager earnestly hopes that he can count upon the best of co-operation with Mr. Goette from all amateurs located therein.

Mr. E. B. Duvall, who was recently appointed A.D.M. in charge of the Southern Section, which comprises the States of Penna., Delaware, Maryland and the District of Columbia, has appointed Mr. George L. Deichmann, Jr., (3HG), Park Heights & Bancroft Park, Baltimore, Md., D.S. for Eastern Maryland, and Mr. Roger

W. Clipp, (3ABC), 112 Broadway, Hagerstown, Md., as D.S. for Western Maryland. These appointments have been approved by the Division Manager. Both of these gentlemen are well known in their sections and in outlying territory, owing to the DX work they have carried on. The Division Manager is particularly glad to know that the League will be properly represented in the Western part of Maryland, as he has desired to see the development of the projected Southern route of Trunk Line B, through southern Pennsylvania and western Maryland either to Washington, Pa., or Pittsburgh and other western points.

Attention is invited to the creditable work accomplished by the station of Mr. J. K. Hewitt—2RK. It has been brought to my attention that an operator on a transatlantic vessel, enroute New York to London, reported that he heard the signals of 2RK QSA and steady every night. On the eastbound trip this operator copied many amateurs up to 1730 miles from N. Y. but lost all but 2RK on the next night approaching London. Receiver used on vessel was a Navy SE 143 and SE 1000 amplifier. English ships also heard signals of 2RK while inside of Gibraltar, a distance of over 3000 miles. This station has also been reported consistently by coastwise steamers running in the Gulf of Mexico, and has actually worked 37 states and has been heard in 40 states. Mr. Hewitt believes these results to be a world's record, and in any event it shows what may be accomplished by careful and painstaking attention to details. There is no particular reason why such performances cannot be duplicated by other stations in the Division, and we expect to hear of this being a fact in the near future. (2RK handles hundred of messages each month, but Gawdnose, he does not report them as he should.—Tfc. Mgr.)

The Benzee Bros., Acting D.S., Western New York, reported in the latter part of January that the relay work in their section was going along nicely, and that a total of 176 messages had been handled as follows: Buffalo—8SL, 2; 8LB, 21; 8MF, 1; 8KU, 3; 8FE, 24;—Lockport—8IL, 14; 8AHV, 7;—Rochester—8GI, 38; 8AMQ, 14;—Oakfield—8AMZ, 32. They report that 8MF and 8AD are again working. The Radio Association of Western New York has been affiliated and every member is working for the betterment of radio and the prompt handling of traffic. Tests have been under way with Erie and Toronto, but have not been successful. Mr. R. D. Haire, 8GI, of Rochester, has been appointed City Manager for that place, with the object in view of getting the local organization to control QRM which has been hindering the advancement of radio there. Benzee Bros. call attention to the fact that at present there are no routes running into the southern and southwestern part of N.Y. State, and they would be very much pleased to hear from stations in the vicinity of Jamestown, Olean, Dunkirk and Syracuse. Benzee Bros.' address is 196 Keystone Street, Buffalo, N. Y.

Mr. Harry S. Collins, D.S. Northern Section of Long Island, Babylon, N. Y., also reported late in January that the station of Mr. Tremaine Hulse, of Bay Shore (2BGR) will be on the job every night between 9:30 and 10. At present he states that the best route through his section is via 2JU, 2ZL, 2OE, 2FS, 2AJW and 2BCR then across the Sound to 1HO, 1FW,1HAA, etc. 2BGR and 1HO have a regular schedule. Some spark coil QRM is being experienced, but much QRM is also being had from WSE and NDD.

In the Southern Section Mr. Duvall, the A.D.M., states that some of the D.S. are slow to send in their reports. D.S. Central Penna., Mr. H. M. Walleze, reports that 3ABD of Danville, Pa. is doing fine work. Station 8XE at State College has been active, but QRN has been bad the past month. 8XE does not seem to be able to work Pittsburgh in a satisfactory manner. During the past month 63 messages were handled by this station. Mr. Walleze states that 8BQ has not been changed to 8AJB, but that this call has been assigned to a portable set.

D.S. Eastern Pensylvania, Mr. S. W. Place, reports that due to the fact that the antenna and mast of his station 3BH were recently wrecked by a storm he has been unable to keep in touch with the activities of his section or handle any traffic. His A.T.M., Mr. R. C. Ehrhardt, of Dunmore, Pa. reports that 8ACS of Scranton, Pa., is getting lined up for DX work.

Mr. Duvall, who was still acting D.S. Eastern Maryland Dist. during the past month, reports stations 3HG, 3AHK, 3UC, 3OU and 3EQ doing good work handling traffic through Baltimore. 3HG and 3AHK seem to be running a race in the matter of handling traffic. 3EQ is reaching out with a C.W. set and when some further improvements are made it is believed that it can be counted upon as a reliable DX station. The latter named station is operated by J. Q. A. Holloway and C. E. King. The station of the A.D.M., 3EM, has been in operation for some time, but so far no DX work has been done, his station principally being used for control work in Baltimore. The station of 3AN, Yearly, which has been out of commission during the present season, will soon be in operation again, as his wrecked mast has been re-erected, and he has also added to his equipment a CR-3 and 2 step amplifier.

Doubtless Yearly will soon win back his laurels as one of the most reliable stations in Baltimore. While no reports have been received from the Dist. of Columbia, the A.D.M. states that he is personally aware that the stations in that section are very much alive, and that 3XF, 3IW, 3KM and 3ALN are consistently heard, and that a fairly reliable schedule has been arranged and is in operation between Baltimore and Washington. Conditions between Philadelphia and Baltimore are reported still unsatisfactory. Perhaps by means of C.W. this section will be bridged before long. There are a number of stations working on C.W. sets in Philadelphia, and as soon as it is felt to be practicable stations of the same class should arrange for tests and schedules with similar stations in Baltimore.

What was without doubt the most successful Convention yet held by amateur radio men was that which was promoted and managed by the Second District Radio Council. This Convention was held in New York at the Hotel Pennsylvania during the four days of March 16, 17, 18 and 19, the affair ending up with a Banquet in the Ball Room on Saturday night at which nearly 600 radio enthusiasts were present, including a number from distant points. It was well worth while to attend, and the Division Manager felt much pride in the knowledge that the radio enthusiasts of Northern Section of his Division were able to carry out their plans in such a successful manner. The exhibits of Radio apparatus in the Roof Garden made it well worth while to attend, if for no other reason, although the pleasure of meeting so many of his fellow amateurs was the most attractive feature of it all. To Mr. J. O. Smith and the other members of the Committee of which he was Chairman much credit is due for the hard work done, and the nerve required to carry it out upon the large scale attended. It was a great thing for amateur radio in that section.

NEW ENGLAND DIVISION.
G. R. Entwistle, Mgr.

A.D.M. Robinson, (1CK) reports that the air is full of C.W. now-a-days and anyone with a bulb receiver can get in on this and the best part of it is that you are just as likely to hear a DX station as a local, more so in fact, because there are more DX-C.W. sets than local.

A very noticeable piece of real citizen radio was heard on March 4th at 2:20 a.m. when 1HAA shot fourteen messages to 1TS without stoping, with a bug key at the rate of about thirty words per minute, and at the end of it all Mix came back with a laconic "dit dah dit".

1HAA handled 608 messages during the period between Feb. 20th and March 20th. 1DY handled 160 messages, 1CY 240; 1CK has been too busy to get in on the DX stuff lately and only handled 100 messages.

Johnson (1DY) of Lynn, has been doing fine work in his district, but does not receive reports from the relay men as desired.

A.D.M. D. H. Mix (1TS) reports that 1AW has been on but two or three nights during the past month and this accounts for some of the decrease in activity. 1NAQ has just put in a C.W. set and putting out 1 amp. 1TS handled a total of 77 msgs. during the past month.

D.S. H. E. Nichols, reports 1BM handled 58 msgs. and 1HO handled 79 msgs.

A.D.M. H. W. Castner (1UQ) reports that 1RAY is doing some fine work. They are in communication with many Canadian stations and aside from some local induction that bothers at Burlington, they can work many of them. Bowdoin College (1NBJ) is now operating and in Portland 1FV, 1RAS, and 1UQ are on most of the time. 1VY and 1UL in Bath are on most of the time but beyond that in the other cities of the state, there are no stations that are able to handle relay traffic at present.

Portland has formed a C.W. Club.

Let us try to get the reports in on time instead of none at all as in the past.

Total msgs., 1322.

Busiest station 1HAA—I. Vermilya, Marion, Mass., 608 messages.

ROANOKE DIVISION.
W. T. Gravely, Mgr.

Old Man Static has been on the job incessantly during the past month, with only an open night here and there. This has caused a slowing up in traffic throughout the Division but even under this handicap a number of messages have been handled. However, as the warm weather approaches there will be less and less activity, unless stations link up so as to make daylight operation practical. This can be done, but it means efficient plants at distances not exceeding 100 miles, and before this Division can hope to cover the territory, considerable work must be done. We have strong hopes of developing a day route from northern West Virginia on down into Roanoke, Va., and thence on down to Charlotte, N. C., through Lynchburg, Danville, Winston, Salisbury, and Greensboro, with an alternative of Winston or Greensboro.

Operations will continue all summer. There is no "next season" any more, and if conclusive proof is desired on this subject, just keep your ears to the phones, and there will be surprises. Especially will the C.W's. shine during the warm months, but the old familiar sparks may be heard, too.

Every D.S. is requested to bend his efforts towards creating day lines, so come on, fellows, and let's put the job across.

Mr. Wohlford D.S. S/W Va. is still trying to work out a route to the West, through Bristol, and intermediate points; also a reliable line up through West Virginia, in conjunction with Dist. Supt. Heck who is still hammering away on the West Virginia situation.

8SP is still doing the "star" work in Northern W. Va., and is clearing a considerable amount of traffic.

D.S. Bunker of North Carolina, with the assistance of Mr. Gluck, is clearing up the North Carolina situation. There are three good stations at Winston, N. C., all capable of clearing considerable traffic, 4AL, 4CK, and 4CX. 4CC at Greensboro promises to take hold in the near future.

Mr. Blair, 3ZL, D.S. Central Virginia, reports great activity in their radio club and a membership of 85. He also introduces this month Mr. R. R. Chappell, 3ZP, who will assist him in the handling of Richmond Traffic. 3ZP will use C.W.

Mr. Blair reports about 30 stations operating in Richmond now, which number includes spark coils and other types.

Mr. T. C. White, Jr., C.M., Norfolk District, reports his vicinity has been seriously handicapped since last report by the terrific static almost every evening after dark.

Messrs. Hopkins and Buskey of 3GO have handled a good part of the traffic, having three operators, and maintaining a watch every evening.

Sgt. Blair of XF-1 at Langley Field deserves a great deal of credit for his assistance in clearing traffic North and West. Sgt. Blair is looking for a good C.W. station south so that he may clear his southern traffic in the same easy manner in which he clears North and West. (Southern stations please note, and write Sgt. R. H. Blair, Radio Headquarters, Langley Field, Hampton, Va.)

Sgt. Blair works Washington and New York in the day, with ease.

The C.M's. station, 3EN, has handled quite a number of DX messages since last report. His spark has been reported QSA in Tela Harbor, Honduras, by an operator on one of the Tropical Radio Telegraph Co's. ships. His greatest desire, at present, is to find a daylight route to Danville and Washington, also South, in order to clear in the day those messages which are hung up at night. Mr. White has established day communication with Elizabeth City, N. C., 4EY.

No change in the QRM from NAM's arc set and three spark sets.

Total mesages, 275.

EAST GULF DIVISION.
E. H. Merritt, Mgr.

About half of March was 'spoiled' for radio work in this Division by very heavy QRN of regular mid-summer intensity that kept us from doing as much work as was expected. 4XC experimented with an underground aerial and by using it had more success handling traffic than any other station reporting.

4XB has been doing fine work with C.W. 4YA has been giving concerts twice a week but power is small and they have not yet been reported over 50 miles.

Supt. Gulledge (4ZN, ex-4AT) reports that he expects to be connected with Key West soon. THE ROUTE TO FLORIDA IS AT LAST A REALITY, traffic going thru 4FD and 4GN easily. Both are in Midville, Ga.

Supt. McIlvaine reports nothing new in Alabama during the past month.

4AG has been testing with 4YA and 5XA but has been unable to connect with 5XA. There is at last good connection between 4YA and 4AG (50 miles) with 4YA using 250 and 700 meters. 4YA would like to arrange for tests with other stations to listen for the long wave. A radiofone set was mounted on a truck and started in the direction of 4AG during the month to try to get a line on the QSS and other peculiar conditions between the two stations but all attempts were 'busted' by severe QRN from storm clouds. Connection was made with 4YA up to about 30 miles but 4AG never did get any sigs. More of these tests are being planned later on and 4FD is planning a similiar test between his station and Savannah.

4XC reports 88 messages for the month and 4YA reports 26 for about ten days operation. Total messages 114. 4FD reports 22 msgs. to be added to the Feb. report. Only two stations reported for March. Let's hear from the East Gulf men on this each month.

DAKOTA DIVISION.
Boyd Phelps, Mgr.

In spite of the apparent early coming of summer the message total for the month of March is larger than for any previous month. There are still many stations that do not send in a monthly report of their total messages sent and received. We should receive credit for the work we are doing so please, everyone, send in your report in time to reach your District Superintendent by the 20th of each month, or if delayed after this date mail it direct to the Division Manager.

Mr. Harold Larson, 9KG, has been so busy with business that he has been unable to devote the necessary time to the District

of South Dakota. Because of his love for the A.R.R.L. he has resigned in favor of Mr. N. H. Jensen, who has shown his ability as City Manager of Sioux Falls and will undoubtedly push South Dakota to the front. Mr. N. H. Jensen, Box 894, Sioux Falls, has been appointed District Superintendent and has prepared and mailed a circular letter to every amateur in the state that he knows of in the effort to organize branch and summer routes in his district. Mr. Charles Norton, 9AIF, 521 West 11th St., has been appointed City Manager of Sioux Falls. Mr. Norton and Mr. Jensen have done much to make the local Y.M.C.A. club (affiliated) one of the liveliest and peppiest in this Division by staging contests and events of all sorts.

D.S. E. S. Leavenworth, 9WU, Ellendale, N. D., has been spending most of his time moving traffic over the Northern Route in a most commendable fashion. Station owners to the west and northwest of him should write him and find out his plans for the branch and summer routes now being laid out. Mr. Chas. D. Curtis, 9YAF, at Pembina, N. D., has been working with Winnipeg stations 4AU and 4BG at 5 P.M. every afternoon and at the same time with 9AGN at Fargo and 9ZC at Baudette, Minn.

Mr. J. A. Gjelhaug, 9ZC, Baudette, Minn., has been corresponding, visiting and working with the Winnipeg fellows, getting them enthused over A.R.R.L. traffic. In Duluth and Superior, according to latest reports, there has been a rapid spread of the disease called "CWitis" and spark sets are being sold by the pound. We will have Mr. Bridges, 9DBT (ex "BQ") at Superior to handle traffic for the Twin Ports.

In the District of Southern Minnesota 9XI has handled the most traffic but during the previous months 9HM has been in the lead. Of the 193 messages handled at 9XI 60 per cent were on C.W. Mr. C. M. Jansky in charge of the University station has computed curves showing the percentage of calls completed on C.W. and spark and curves showing the reliability of each during varying periods of static based on the log of 9XI. Mr. H. R. Hall, 23 Merriam Place, St. Paul, Minn., has prepared a circular letter in the form of a questionnaire that he has been mailing to stations he hears in sourthern Minnesota. 9AMH at Northfield is regularly worked in daylight by 9XI and 9ZT.

Several good summer routes are in view, the best of which will be from the Twin Cities to North Dakota via 9SV, 9ABB, 9RJ, and 9LW. From 9LW at Wahpeton, N. D., the prospects look fair for a route west to Bismark but from there west to the 7th district the scarcity of stations makes it doubtful. A good summer route can be maintained from 9LW north via 9AEJ, 9AGN, 9YAF, to 4BG. Also south from 9LW there a good chance for a route to Sioux Falls, S. D. The places where stations are sorely needed are in the western part of North Dakota, central part of South Dakota, northern Minnesota especially between St. Cloud and Duluth, and in the southern part of Minnesota south of Northfield. The Division Manager would like to hear from anyone that has or knows of any stations in the above mentioned territories.

Total messages 1262. Busiest station 9WU—225 msgs.—E. S. Leavenworth, Ellendale, N. D.

MIDWEST DIVISION.
L. A. Benson, Mgr.

The Division Manager requests that all stations in the Mid-West Division operating C.W. communicate with him at once regarding a proposed C.W. route through the respective territories. This route will do away with the interference now experienced by spark stations throughout the Division.

9HT reports that many stations in and about Omaha are considering the installation of C.W. equipment. 9APA of Omaha has started his installation. Anderson, 9EW has been operating at 9HT during the past month. Tests are being conducted to determine upon the best method of handling traffic during the coming season. The following DX Omaha stations will alternate in carrying traffic, 9HT, 9SC, 9EW, 9DIT, 9VE. Local QRM problems are being handled by the Aksarben Radio Club of Omaha. 9EL reports that he is sending circular letters throughout his territory to gather information regarding day-light routes through Kansas. In addition to the circular letters he is getting in touch with all district Superintendents of bordering states for connecting routes in all directions, so that throughout the summer months traffic can be handled in short jumps.

Stations that are doing excellent work in Kansas are 9SZ, 9OE, 9PS, 9ALG, 9LB, 9AQE, 9AIZ, 9ALU, and 9AZB. The following appointments have been made in Kansas. 9AEG., Ira Graham, Eldorado, Kansas, second assistant district superintendent; 9OE, Paul Willis, Wichita (Kansas) city manager. 9HI, Bert VonWolf, Topeka (Kansas) city manager. 9JA of Iowa reports the following stations doing excellent work in handling traffic: 9MS, 9IY, 9JL, 9DBS, 9AMU, 9YA, 9DAU, 9OA. 9DBS located in the western part of Iowa forms a long-needed link in the Western line. 9AEQ, 9JN and 9ZQ continue to work DX. All stations in Iowa are to report to 9JA regarding the number of messages handled and also signals

heard. The North route to the coast is working to perfection. The short jump route to Chicago and around East never fails. It runs from the central part of the state to stations 9YI, 9JN, 9JA, 9JL, 9YA and 9MS.

9DU of Independence, Mo., reports that daylight routes through the state of Missouri are working to perfection. He reports two new stations in Kansas City who are working on schedule from noon to 2:33 P.M. the latter clearing to 9QO, 9EX, 9FL, 9AAG, 9MW, and 9YN. 9XAB of Kansas City will prove a very valuable relay station. 9LR proves to be the main linking station between this territory and the west coast.

Total number of messages handled, 3,120.

WEST GULF DIVISION.
R. L. White, Asst. Divn. Mgr.

D. S. Dill reports: "Traffic in Oklahoma is on the jump despite QRN. As the stations of Oklahoma become known traffic is intrusted with them."

A.D.S. Poor of The McAlester Territory states that his section has continued in a slump this month. He is changing from a half to one K.W. 5KW is installing a C.W. set, also 5HF at Oklahoma City.

A.D.S. Selby of The Muskogee Territory informs us that there are several good stations at Muskogee. Among them is the famous station 5BR who has been reported QSA in New York and Pennsylvania states. Muskogee is proving to be a very important point and much traffic is being handled, being located on Trunk Line F. 5LO of Miami is installing some new equipment. A new station has sprung forth at Enid, his call being 5JR.

5HL and 5HK have consolidated as station 5HL and will afford two operators, maintaining a better watch than heretofore.

D.S. Falconi of Roswell failed to send us a report. (S'matter, Louie?—White).

D.S. Harold P. Heafer reports The Waco Texas Territory has had very little activities account heavy QRN. A.D.S. Martin of The Amarillo Texas Territory reports he has received confirmation that his station (5IF) has been heard in 14 states, and his enthusiasm is greatly increased. A.D.S. Pierce states activities in The Corsicana Texas Territory are slow, as many stations are being remodeled and QRN heavy.

No reports were received from A.D.S.'s, Dorsa of The Dallas Texas Territory, and Butcher of The Greenville Texas Territory.

A.D.S. Guy Neel, pro tem, of Dublin Texas, reports traffic going through. From December 15th until Feb. 10th he handled a total of 190 messages which were not included in our report of previous date.

Due to the fact that the original plan of assigning territories has out-grown itself, it has been decided to make changes in the entire North Texas District in the line-up of A.D.S. These changes have been carefully considered at a meeting of the D.M., A.D.M. and the D.S., and were approved and adopted as official, effective April first. For the information of those concerned we present our plans. Let us say that one point we desire to bring out is the appreciation and admiration we want to express for the valuable assistance and co-operation shown by the old A.D.S.'s, of the entire Northern Texas District. We feel sure that the A.D.S.'s whose offices expire will readily see that the change is made solely for the purpose of benefitting the League, and that they will continue to lend their co-operation to the new A.D.S.'s.

After April the first, The Northen Texas District will be divided into three territories only, namely: (1) EASTERN, (2) CENTRAL, (3) WESTERN. (1) The Eastern Territory will have headquarters at Dallas, with Mr. John Dorsa as its head, and this Territory shall consist of all Counties west from the boundary line of Louisiana to the western boundaries of the following Counties: Cooke, Denton, Tarrant, Johnson, Bosque, Coryell and Lampasas, extending the entire length north and south of the District. (2) The Central Territory will have headquarters at Dublin, Texas, with Mr. Guy Neel as Asst. Dist. Supt., and this Territory will consist of all counties west from the boundary of The Eastern Territory named hereinabove to the western boundary lines of the following counties: Hardeman, Foard, Knox, Haskell, Jones, Taylor and Runnels, extending the entire length north and south of the District. (3) The Western Territory will have headquarters at Amarillo, Texas, and Mr. J. L. Martin will be in charge of this Territory, and it shall consist of the counties west from the Central Boundary Line named herein, to the extreme eastern state line of New Mexico.

The southern boundary line of The Northern Texas District is considered as the southern boundary of the following Counties: Andrews, Martin, Howard, Michel, Coke, Runnels, Coleman, Brown, Mills, Lampasas, Bell, Milam, Falls, Limestone, Freestone, Anderson, Cherokee, Nacogdoches and Shelby.

Mr. Yewell Cornelius, President of The Fort Worth Radio Club, informs the A.D.M. that internal disputes which have been numerous with his club have been thrashed out and, their Club is more encouraging than ever before.

There are two 1K.W. stations, one ½ K.W. station, one ¾ K.W. station and about a dozen spark-coils in Fort Worth.

The Club at Ft. Worth has made application for affiliation with our League, and

they are installing a radiophone set this summer. They are situated like the Dallas Radio Club, they meet in a church building. Their permanent headquarters are located in the Sunday School building of the First Baptist Church of Fort Worth.

D S. Tilley, of The Southern Texas District reports Radio activities in Austin and vicinity have been an impossibility for the last month on account of the terrific QRN. The Austin stations have about quit for the season except 5ZU who is getting lined up in the new location for the summer run.

A.D S. Alfred P. Daniels, of Houston reports as follows: It is with regret that the report from this territory, will of necessity be very uninteresting this month, for the reason of the fact that practically all high powered stations have been shut down since February 19th. QRN has been playing with us, and if he calls it a visit, it resembles a visit of our country cousins and other relatives. The only DX work possible is with stations located within the adjoining counties.

This territory has lost a good station, 5EO, located at Freeport, Texas. Operator John Whitworth has moved to Waco, Texas, but promises a good station there.

Much C.W. is being heard in Houston. Most of the experimenters are still in the heterodyne stage, but are having good results with that arrangement.

Port Arthur, Texas has organized a Club with L. W. Hatry as President, and will be ready for affiliation shortly.

5HV and 5IF are being heard regularly at all Houston stations.

Re our monthly report in March issue of QST please be advised that all A.D.S.'s, monthly reports must be in the D.S.'s hands not later than the fifteenth (15th) of each month and not the eighteenth (18th). This report is very important so please see that these instructions are followed out. Total messages 369.

NORTHWESTERN DIVISION
J. D. Hertz, Mgr.

QRN is coming boys, but along with it seems to be coming better working conditions. Most of the fellows report that while Old Man Static is stirring up more or less of a fuss, still they seem to be having less trouble with QSS.

A.D.M. Cutting, reporting from Montana, says there are now three routes for traffic over the great Northern trunk line, the trunk which proved itself the most consistent, and most consistently speedy during the recent A.R.R.L. Transcons. These routes are: via 7CC to 7EX to 9WU or 9EE; via 7YA to 9YW; via 7CC or 7ZH to 7ZG to 9YW, 9WU, or 9EE. There seems to be a preference for the last two, due to QSS trouble between 7EK and 7CC.

Satisfactory daylight tests have been conducted between 7ZG, 7LU and 7DH. Others are being arranged between 7ZG and 7EX and 9WU.

Cutting's own station, 7LY, is now on the job and doing good DX work. He is in direct communication with 7HS, 7YA, 7ZG and 6OT.

We are promised a new station, 7LM, at Yakima, Wash. This station is undergoing extensive overhauling for the relay work, and will be on the job to help keep trunk "A" open during the summer.

Mason reports that Seattle has been a pretty dead place during the past month, even tho Seattle stations have been handling the bulk of the Tacoma outbound traffic. Most of the business thru this city has been going via 7AD and 7BK, tho 7IY and 7CA have been doing good work. He also says that there seems to be a CW craze raging there.

7CC is busting in a second op. This will help a lot toward keeping Moscow on the map as a most reliable radio relay center. Woodworth reports that there is every prospect that Trunk "A" will be kept open this summer, for the "Nines" are now rolling in even better than ever during the winter. And with 7EX and 7ZG in Montana doing their best to keep things open there is no reason why things should get "'gummed up." 7FI and 7BQ of Pullman are also doing commendable relay work.

At Portland 7DS, 7ED, 7BP, 7ZI and in Vancouver 7CU, 7BJ and 7ZK are keeping traffic for this district moving well. Difficulty is still encountered in working north to Puget Sound points, and some trouble is experienced working 7CC now on account of QSS, but traffic south continues to move without delay to innumerable sixth district stations.

Total messages 407. Busiest station 7CC. Jack Woodworth, Moscow, Idaho.

PACIFIC DIVISION.
E. G. Arnold, Asst. Mgr.

Things have been getting pretty bad around San Francisco Bay. It is almost an impossibility to do any work on a wave of 200 meters. We are glad to report that several new names have been added to the list of special license stations in this district.

By carefully placing these special licenses in the hands of the people most fitted to handle the work it has made it possible to handle the work in a more reliable and efficient manner.

6ZM, Mr. Wilson of Salt Lake City, Utah, has proven himself of valuable importance in our A.R.R.L. work. Traffic has been handled with him from the coast fairly regularly at a speed that is surprising, as 30 words is slow for Mr. Wilson.

6ZY, Mr. Roebuck of Santa Barbara, Cal., will have his 375 wave in operation shortly and then we are assured of a relay station for southern traffic eliminating long unnecessary jumps. The set will be in the hands of a man who is a real operator.

Old 6EJ now 6ZX reports that he has handled 300 msgs. during the month.

Routes are open to the East via South: 6ZZ ex 6IG of Douglas, Ariz., and 5ZA, of Roswell, New Mex.

Routes open to East via North: 7YA, 7CC.

We are practically assured that it will be possible to keep the line running in full blast the entire summer.

7YA is easily worked, in fact has been worked by 6ZR of Burlingame, Calif., in broad daylight.

6OH of Ukiah, Calif., reports that he has handled 36 messages for this month, which is very good considering his location.

The A.R.R.L. QRX period originated by our manager Mr. Bessey, the purpose of which is to listen for eastern and other distant stations, is being observed around the Bay District, due to the strenuous efforts of the men in charge, 6ZR and 6AT. It is rather a big job due to the number of junior operators now on the ether, as well as the numerous ambitious CW and fone stations, who are always anxious to have the world in general hear their latest jazz piece on their fony-graph. QRN has been interfering with this plan and unless it abates to some extent the plan may temporarily be abandoned. This is a big job and requires the co-operation of all concerned, and it would be greatly appreciated by the men in charge if everyone would help them in this matter.

ALASKAN DIVISION.

Roy Anderson, Mgr.

Practically every town in Alaska has a Commercial or naval radio station, the power of which varies a great deal. Nevertheless it is always sufficient to cause a great deal of QRM and it probably has a tendency to discourage amateur radio, altho there is no reason why it should if the amateur has a genuine interest in the game But that is just it. They have no incentive. They have no one with whom they can communicate. They have no fellow amateurs, and they have no organization. That is where the A R R.L. will figure should the manager of this division be successful in rounding up such amateurs.

As regards QRN very little trouble is experienced, especially in southeastern Alaska. This is probably due to the fact that it is situated in the temperate zone. Naturally there is some, but not enough to seriously hinder the handling of amateur traffic. There is, however, SOME trouble experienced from induction, but it is very seldom that it becomes necessary to take off the phones and turn off the bulb. The only thing that necessitates that is sleet, being driven around the aerial by wind in such a manner that one is able to get a gretty good spark on the lightning switch.

Therefore, the writer believes that communication by means of amateur radio, in Alaska, is possible, if the right kind of stations with the right kind of operators are put in. Patience, to a certain extent, will count a whole lot in the handling of such traffic, but we should grin and bear it, for amateur QRM in the "states" is probably a whole lot worse than can ever be caused by Alaskan stations handling commercial traffic.

Let's hear from Alaskan amateurs.

ONTARIO DIVISION

A. H. K. Russell, Mgr.

Citizen wireless in Ontario is much as usual, with progress slow but steady. Intercity traffic is increasing and Toronto District is at last in touch with Brantford and Napanee. A new station in Peterboro gives us promise towards Ottawa, in Mr. Sherwood, 3MB.

Caton, Napanee, is hoping to install a power C.W. set soon, and mentions communication by C.W. between, Napanee, Kingston and Belleville. One way traffic is at present carried on between 3FE and 3AB, Toronto.

In Toronto, a veritable epidemic of QRM has burst forth, and it is almost impossible to work through to American stations thru the interference barrage. However, a fair number of messages have gone thru via 8CG and 8ANJ. 3AB has established communication with 3BA in Brantford, and has been copied in Chatham by XEM, the Training School Station, (which already has worked 8ZR and other stations to the south), on both C.W. and voice. Wm. Gray in Chatham, 3FM, has a DeForest 4 bulb transmitter with which he is doing good work. In Kitchener station 3DS is beginning to reach out, and is remodeling his aerial in the hope of making Toronto traffic regular. He has at present a one way schedule with 1HAA, which has had good results, several messages having been forwarded in that way. Total messages 22.

Do you want an appointment on a relay route? Write your Division Manager and give him a description of your station.

Who's Who in AMATEUR WIRELESS

F. Clifford Estey

Is there anyone who doesn't know Estey, whose fame has been sung up and down the country as the able president of the Essex County Radio Association, with headquarters in Salem, Mass.?

Born in Middleton, Mass., June 5, 1893, he moved to Salem in 1906 and has since called that place home. He had to start in the radio game some time, of course, so chose an early date—about 1906—and struggled thru the days of coherers and decoherers, carborundum and electrolytic detectors, and once even saw a Marconi magnetic detector. He had his first transmitter before he knew there was a code; it was a pair of those awful "transformer coils" with electrolytic interrupters; later he bot a 1 k.w., closely followed by 2 k.w. and then by 3 k.w., using a wave length of 1600 meters, and only the radio law of 1912 saved him from bankruptcy. During 1911

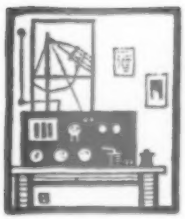
(*Concluded on page 46*)

Don I. Bailey

Operator "DA" of Radio Station 9CS, Clinton, Iowa, was born in Luverne, Rock County, Minnesota, moving with his folks to Iowa at the age of 11 years. There, after experimenting with different vocations—automobiles, motor boats, cartooning, drafting and Morse line telegraphy—he finally became a disciple of Marconi.

He was then a reader of "The Open Exhaust" (a motor-boat publication) and happened to be looking over the classified ads. one day when he noticed the Mississippi Valley Power Boat Association had two complete wireless sending and receiving sets for sale for $25.00, used only a half hour in timing the mile-against-time dash. He wrote the secretary of the M.V. P.B.A. to hold the sets for week and he would take them off his hands. The secretary didn't wait, but shipped them at once. The sets consisted of two pairs

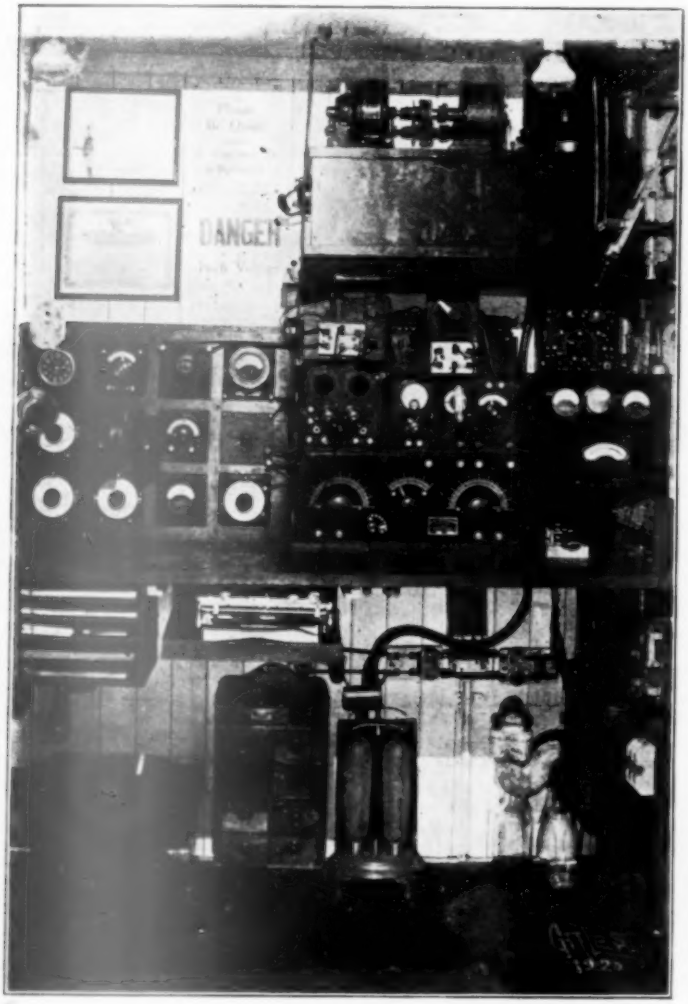
(*Continued on page 46*)



Amateur Radio Stations

4BQ—A Southern Station

From time to time the A.R.R.L. has wished there were stations in the East Gulf Division. What we meant was more stations like this one, 4BQ, owned by Mr. G. L. Hight, of Rome, Ga.



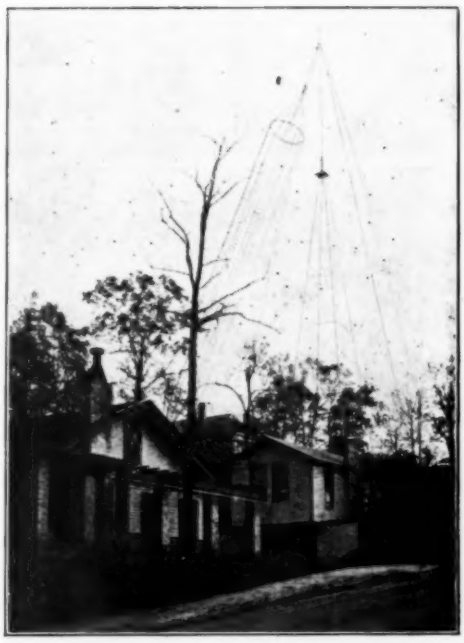
Taking up the antenna first, Mr. Hight has a steel tower of 125-ft. over-all height. The height of the tower proper is 85 ft., with an extension of two 23-ft. lengths of 2-inch galvanized pipe welded together and reinforced at the joint with 4 ft. of shafting turned to a driving fit. The 85 ft. part cost $145, and Mr. Hight considers such an aerial support the cheapest and best in the long run. The aerial at present used is a cage of eight stranded wires 90 ft. long, running almost vertically. It has one hoop at each end, 8½ ft. in diameter, with the lower end of the cage coming directly to the lead-in bushing immediately over the transmitter. The ground system is quite a conglomeration, consisting of several hundred driven rods, several charcoal pits with water connections for moistening, chicken wire, copper ribbon in radial ditches, all the usual piping systems, and an iron fence.

The transmitter is the old-style Clapp-Eastham Hitone, and with 4 amperes antenna current and a pure 200-meter wave, 4BQ has been heard several times in North Dakota, a distance of 1300 miles.

As to the receiving equipment, on the

left is a DeForest unit set using honeycombs for waves over 600 meters, and on which most of the European stations are copied with one bulb. A Chicago Radio Laboratory regenerator in the foreground is used for amateur work, while the two-step amplifier immediately over it can be used on either set.

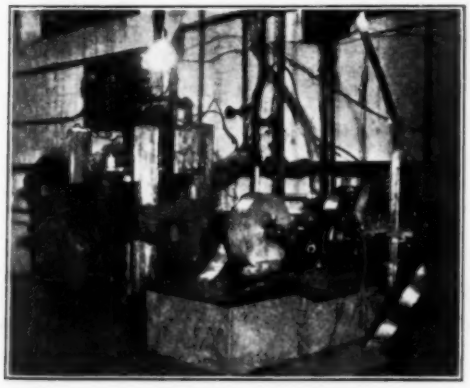
4BQ is fixed up with lots of little conveniences. Note the stationary cabinet and the Corona on a sliding drawer under the table, the electric stove, Tungar rectifier, the cabinet for tools and spares. The radio headset may be connected to the city phone, shown on the extreme left, so that land-line communication can be had without removing the headset, while in addition the phone line can be connected to the receiving set so that Mr. Hight can call up his friends and let them listen to radiophone concerts he receives. This is done by the simple expedient of running one side of the main line of the telephone thru the primary of an Acme modulation transformer and connecting the secondary in series with the radio headset, which is the most satisfactory way discovered and in no way interferes with the operation of either the telephone or the receiving set.



3XM, PRINCETON UNIVERSITY

3XM is probably better recalled to mind by the call letters it had until recently, 3DH.

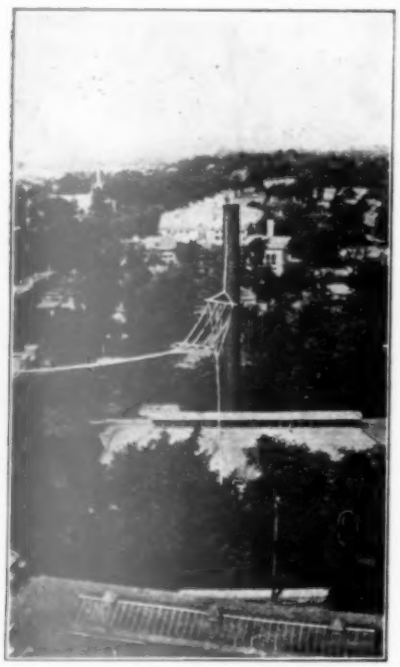
Perhaps the main feature of the whole 3XM equipment is its simplicity and lack of the usual myriad of switches and what-not that one sees in the average amateur station. The receiving set and control room is in the Science Building and consists a Paragon RA-6, four pairs of phones in series, and detector-two-step-amplifier unit mounted on a long table. The only remaining things on the table are two keys, power relay, and a switch for the rotary gap. The receiving aerial is one wire going up over the roofs to a tower 120 feet high. It is two hundred feet from the sending aerial and sending set, which is located across the street in the pump room.



The sending set consists of a specially built American constant-voltage (40,000) transformer, which complete weighs 500 pounds. The condenser is of three units of 50 plates each, of 10" by 14" double thickness window glass, oil immersed. The three units weigh together about 400 pounds. The oscillation transformer and connections are all three inch brass ribbon. The rotary is a specially built quenched, the disc having fourteen points and four stationary electrodes. It is directly coupled to a 1/6 h.p. 1750 r.p.m. induction motor, giving a rather peculiar note.

The transmitting aerial is an inverted L, one hundred feet high and seventy-five feet long, the horizontal part having four wires on ten foot spreaders. A steel cable bears the strain, the aerial hanging about two feet below it. There is 60 feet of one inch rope on each side of the antenna in place of the usual cable, preventing unnecessary absorption and giving much better insulation. The aerial is supported by a 100 foot steel stack sixty feet from the east end where the lead-in is, and by a

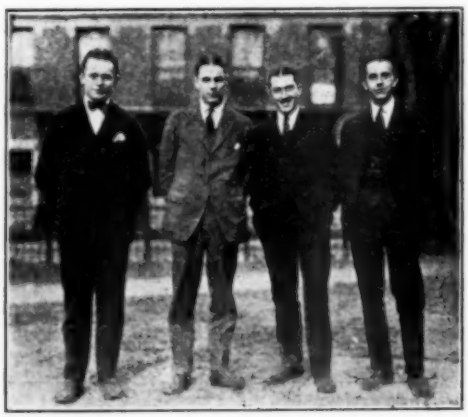
steeple 120 feet high and 150 feet from the west end. The lead-in is spread for thirty feet down, and then is bunched loosely the rest of the seventy feet. This keeps the capacity high up in the air. The ground is connected to three eight inch steam pipes running directly under the



antenna in an underground passage across the street.

3XM employs a very simple break-in system in which the receiving set is always working, a ½ megohm resistance on the detector tube preventing the bulb from paralyzing and a needle gap across the aerial and ground keeping the absorbed energy from sparking in the receiving set. The sending set is controlled by relays. This system works perfectly, and there is no such thing as a change-over switch employed; in fact the only switch used controls the relay starting the rotary.

The call 3XM is used for the spark set, and 3DH is still used for the bulb set (phone, C.W., and I.C.W.).

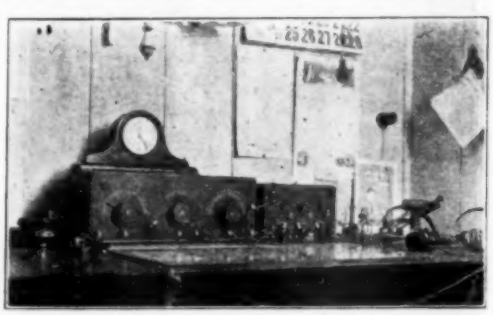


The owners of 3DH and 3XM, shown in our photograph, are, from left to right, Don Murray (DM), Sam Grandin (SG), D. W. Richardson (DR), and Ted Sisson (ES). Folger Frost (FF) is also an owner but must have been on watch when this photograph was taken.

3XM has been copied in all but eight states, in the English Channel, in the Pacific ocean off Mexico and in the Atlantic South of Pernambuco, Brazil. The best actual working records are 9LA; LG, three nights running from Havana to Tampico; HK, from New York to Cuba; DZ, five times while lying at anchor in Tela, Honduras, S. A.

5EJ, AUSTIN, TEX.

Here is the station of Mr. W. L. Gilfillan, Austin, Tex. The aerial is a 4-wire inverted L, 55 ft. long, supported on two masts 92 ft. and 55 ft. high respectively. The spreaders, which are 16 ft. long, are a truss construction giving great strength with light weight. The transmitter consists of a United Wireless transformer, Benwood gap direct-driven, home-made oil immersed condenser and home-made pancake O.T. 5EJ had a new idea in distant control, pull cords operating the gap and transformer switches and so eliminating any A.C. hum in the receiving room. The handles for these cords may be seen high up in the picture of the receiving equipment, which comprises a pre-



war Paragon RA-6, a Grebe detector and

(*Concluded on page 62*)

Calls Heard

HEARD DURING MARCH
Unless Otherwise Specified

Instructions to reporters:

(1) Typewrite or neatly print the calls, "double-spaced," on a separate sheet of paper, running them across the sheet, not down a column, and writing on but one side of the paper.

(2) Arrange alphabetically thru each district, from 1 to 9, with no break between districts, using commas to separate items and putting parentheses around calls of stations also worked—all as per the lists below.

(3) The period covered by the report shall be from the first of one month to the first of the following month. All lists must be received by us by the 10th of the second month, for publication in the next following QST.

HEARD AT SEA.

"DZ" while in port 976 miles south New Orleans, from January 29 to March 10th.
2EL, 2JU, 2RK, 2UC, 3DH, 3EN, 4AG, 4AM, 4AT, 4BK, 4EK, 4XC, 4YE, 5BI, 5CG, 5DI, 5DW, 5EJ, 5ER, 5EW, 5FL, 5HL, 5HW, 5JA, 5JE, 5LA, 5LS, 5XA, 5XB, 5XC, 5YE, 5YH, 5ZA, 5ZC, 5ZD, 5ZF, 5ZP, 5ZR, 5ZU, 5ZV, 5ZX, 8ADE, 8AN, 8BO, 8FT, 8ID, 8IK, 8KP, 8ML, 8WY, 8XS, 8ZA, 8ZC, 8ZJ, 8ZL, 8ZR, 8ZX, 8ZY, 9AAC, 9AAF, 9AAV, 9AC, 9AEG, 9AEQ, 9AEY, 9AFX, 9AGY, 9AKC, 9AMK, 9AON, 9AT, 9AU, 9BW, 9CA, 9CP, 9EL, 9EQ, 9FF, 9FU, 9HI, 9HN, 9HT, 9JN, 9JQ, 9KD, 9KL, 9KO, 9LA, 9LB, 9LC, 9LQ, 9LR, 9MC, 9NQ, 9OE, 9OX, 9PS, 9PV, 9PW, 9QO, 9TV, 9UU, 9VC, 9VZ, 9WI, 9WO, 9WW, 9XM, 9XT, 9YA, 9YC, 9YM, 9ZA, 9ZB, 9ZE, 9ZJ, 9ZL, 9ZN, WL2 C.W., NSF C.W.

Opr., S. S. "City of Flint": Ja.n 18, off east Florida Coast, 8XI, 8ZR. Jan. 22, 100 miles east Norfolk: 1RAY, 3PU. Jan. 24, 750 miles east Norfolk: 1TS, 1HAA, 2AX, 3DH.

2BZ aboard S. S. "Virginia", 1000 miles east of Newport News: 1JB, 1AW, (up to 1600 miles), 1YB. 1UD, 1HAA, 2RK, 2OM, 2TF, 2AHK, 3NB, 3BP (Canadian), 3PU, 3DH (up to 2000 miles), 8MF, 8ZL, 8XE, 8RQ, 9DBT, 9MH, 9ZL, 9DV, (Time when heard unknown—Ed.)

CANADIAN, 3AB, TORONTO, ONT.

All C. W.—2AJF, 2BML, 2ZL, 2ZM. 3AAO, 3ABI, 3MME, 4ZC (8ANJ), 8AGZ, 8IB, 8IK, 8KM, 8JM, 8PJ, 8UK, 8VM, 8VS, 8ZG, 8ZW, XF1.

CANADIAN 3CA, TORONTO, ONTARIO.
March.

1AW, 1HAA, 2BGM C.W., 2EL, 2RK, 2XX fone, 2ZM, Canadian threes too numerous, 3DH, 3EN, 3XF, 3YK, 4XB C.W., 5JD, 8AAW, 8ABZ, 8ACF, 8AGD, (8AGK), 8AIB, (8ANJ), 8ARO, 8BG, 8BO, (8BV), 8CAN, (8CG), 8DP, 8FC, 8FI, 8FK, 8FO, 8GI, 8HA, 8JL, 8KP, (8KZ), 8LV, 8NQ C.W., 8NZ, 8OI, 8OM, 8RQ, 8SP, 8TN, 8XI C.W., 8ZE, 8ZL, 8ZR, 8ZX, 8ZY, 9AAW, 9AAY, 9ABL, 9AOJ, 9AP, 9AR, 9AWX, 9AYE, 9DIW, 9ET, 9FG, 9FS, 9GP, 9HK, 9JA, 9JT, 9KF, 9LQ, 9OE, 9OO, 9QO, 9QR, 9TJS, 9TWA, 9TXU, 9TZX C.W., 9UH, 9UK, 9WE, 9WN, 9XM, 9YA, 9YB, 9ZL, 9ZN, 9ZR.

1HAA, MARION, MASS.

((1AK), (1AW), 1BW, (1BBL), 1BBX, 1BAB, (1CY), (1CK), (1CZ), 1CAG, 1CG, (1CM), (1DY), (1DA), 1DAV, 1DAC, 1DAP, (1EAV), (1EP), (1EK), (1EBS), 1EAT, (1FB), (1FV), (1FBF), (1FBV), 1GY, (1GM), (1GZ), (1GBT), 1HA, (1HAL), (1HO), 1IS, 1IE, (1JBT), (1JAR) (1NAQ), 1NBW, (1OE), 1OBE, (1OAD), 1PY, 1PAW, 1PB, (1QP), (1RV), (1RAY), 1RU, 1RBD, 1SU, 1SN, 1SZ, (1TS), 1TBA, (1UQ), 1UAG), 1UN, 1VAA, 1WAD, 1XT, 1XX, 1XE, (1YB), (1YA), 2AFP, 2ALK, 2AID, 2ABM, 2ACG, 2AHS, (2BO), (2BK), (2BGR), 2AZP, 2ANZ, (2BM), 2CY, (2DA), (2DI), 2DR, 2DK, (2EL), 2FG, 2FD, 2GB, (2JU), (2JZ), 2MME, (2OM), (2OA), (2RK), 2KY, (2TF), (2VA), (2VH), (2ZC), (2ZL), 2ZV, 2WZ, 2XE, (2HN), (3AIC), (3ALN), (3ACS), 3ABC, (3BG), 3CG, 3CM, (3DH), 3DE, (3GX), (3HJ), 3HG, 3HX, 3IB, 3LS, 3NB, 3OU, 3OF, (3PU), 3QW, 3XF, (3ZA), 4AT, 4YE, (8AMZ), (8AGK), 8ANJ, 8AOT, 8ANT, 8AAZ, 8AM, 8ANG, 8ANK, 8AAM, 8AKJ, 8BC, 8BO, 8BP, 8CD, 8DR, 8FN, (8GI), 8GB, (8HP), 8HF, 8HQ, 8IZ, 8JU, 8KZ, 8LM, 8LQ, (8ML), 8NZ, 8LH, 8PL, 8PQ, 8QM, 8QE, 8QQ, 8RG, 8RW, (8SP), 8SH, 8TB, 8TZ, (8WY), 8XH, (8XE), (8XU), 8ZA, 8ZW, (8ZL), 8ZV, 8YV, 9CA, 9EL, 9FN, 9HM, 8MN, 9OC, (9ZN).

1MD, DORCHESTER, MASS.

1BAB, 1GBC, 1JAU, 1NAJ, 1OE, 1QP, 1RAY, 1TS, 1YB, 2AID, 2AJW, 2AXB C.W., 2CT, 2DA, 2DN, 2DR, 2EL, 2FG, 2JJ, 2JU, 2OA, 2OM, 2OO, 2RK, 2RM, 2SZ, 2UC, 2VA, 2XQ, 2ZL C.W., 2ZM C.W., spk., 3ACM, 3AD, 3ALN, 3CC, 3DH, 3EH, 3EN, 3GO, 3HG, 3HJ, 3HX, 3KM, 3NB, 3OU, 3PU, 3XF, VMI, 4AL, 8AD, 8AGK, 8AIO, 8AKA, 8AL, 8ALS, 8AMQ, 8AMZ, 8AOT, 8AWX, 8BC, 8BO, 8CG, 8DR, 8DV, 8FK, 8GB, 8GI, 8HG, 8HY, 8ID, 8JQ, 8JE, 8KP, 8KZ, 8LF, 8MF, 8MM, 8QE, 8QH, 8RQ, 8RW, 8UK, 8WY, 8XE, 8XI, 8ZE, 8ZA, 8ZD, 8ZL, 8ZR, 8ZY, 8ZZ, 9UH, 9AWZ, NSF.

1HO, BRIDGEPORT, CONN.

1AW, 1BBL), 1CZ, 1CAZ, 1EAV, (1FL), (1FY), (1GAT), 1GBT, 1HA, (1HAA), 1HAF, (1NAZ), 1OE, 1PG, 1RAY, 1UL, (1QN), (2AID), (GC), (2AJW), 2BG, (2BGR), 2BML, 2DK, 2DN, 2DR, 2DS, 2EL, (2HJ), 2JU, (2OA), (2OW), 2RB, (2RK), 2SS, (2UA), 2VD, 2XX fone, 2XAC fone, 2ZL fone, 3AC, 3CC, 3EN, 3FB, 3FJ, (3FR), 3GO, 3HG, 3HX, 3IX, 3KM, 3NB, 3OU, 3PU, 3TS, 3TK, 3VV, 8AI (8AAZ), 8ACF, 8AGD, 8AGK, 8AIO, 8AMJ, 8AMM, 8AMQ, (2AMZ), 8OT, 8AWX, 9AXC, 8BB, 8BC, 8BO, 8BV, 8DC, 8DR, 9DZ, 8FE, 8HP, 8HR, 8HY, 8IN, 8IP, 8JE, 8JQ, 8MZ, 8RP, (8RQ), 8SP, 8TT, 8WY, 8XU, 8ZN, 9ME.

1TS, BRISTOL, CT., one tube.

1ABI, (1AW), 1BAB, 1BBL, (1BV C.W.), 1CBT, 1CK, 1CM, 1CP, 1CY, 1CZ, 1DAP, 1DH C.W., (1DR), 1DT C.W., 1DY, 1EAV, 1EBW, 1EP, 1FPB, (1FBK spk. & C.W.), 1FBV, 1FU, 1FV, (1AI), 1GAN, 1GAY, 1GBC, 1GBT, 1GM, (1GY), 1GZ, (1HAA), 1HAF, (1HBP C.W. & fone), 1HO, 1IA, 1IAO, 1IAP, 1IBD, (1IBJ C.W.), 1JAP, 1JAU, (1JBF), 1JQ, (1JX), (1KAZ C.W.), (1KBL C.W.), 1KBM, (1LAP), 1LAS, 1LBR, 1MAD, 1MAU, 1MX, (NAQ spk. & C.W.), 1NAT, 1NBJ, 1NBS C.W., (1OAA), 1OAD, 1OBE, 1OE, 1OT, 1PAW, (1PBA), 1PG, 1QN, (1QP), 1QR C.W., (1QT), (1RAS), (1RAY), 1RD C.W., 1RZ C.W. & fone, (1SAZ), 1SN, (1SZ), 1TBA, 1TBJ, 1TL, (1UJ), 1UL, 1UN,

spk. & C.W., (1UQ), (1VAA), (1VAK), 1WBL C. W., 1WR, 1XM, 1XV C.W. & fone, (1YB), 1YK, 2ABM, 2AFP, 2AJE, 2AJF C.W., 2AJW, 2AKO C.W., 2ALD, 2AQF, 2AR, 2ARD C.W., 2ARY, 2AVR, 2AXB C.W., 2BCC, 2BEH, 2BGH, 2BGN, 2BGR, 2BK, 2BKT, 2BL, 2BM, 2BML C.W., 2BPL, 2CL, 2CT, 2DA, 2DN, 2DR, 2DX, 2EL spk. & C.W., 2FG, 2HC, 2HI C.W., 2IG, 2JB C.W., 2JJ, 2JR, 2JU, 2KP, 2LO, 2MJ, 2MP, (2NN), 2OA, 2OM, 2OX, 2PL, (2RK), 2RM C.W., 2SK, 2SQ, 2SS, 2SZ, 2TB, (2TS), 2UA, 2UC, 2UK, 2VA, 2XG C.W., 2XK C.W., 2XQ spk. C.W. & fone, 2XX C.W., 2ZC, 2ZL C.W., 2ZM spk. & C.W., 3AAE C.W., 3AAG, 3AAN, 3ABD, 3ABI C.W., 3ACD, 3ACM, 3ACQ, 3AFE, 3AHK, 3AIC, (3AN), 3ATZ, 3BA, 3BK, 3BZ, 3CC, 3DH, 3DM, 3DS, 3EH, 3EN, 3EX, 3FB, 3FG, 3FJ, 3FR, (3GO), 3GX, 3HJ, 3HX, 3IB, 3IF, 3IM, 3IX, (3KM), 3LP, (3NB), 3OU, 3PS, 3PU, 3QF, (3RW), 3UF, 3VV, 3XK C.W., 3XM, 3YE, 3YK, 3YV, 3ZA, 3ZS, 4AL, (4CX), 4EY, 4FD, 4GN, 4XC, 5XA, 5YH, 8AAV, 8ACF, 8AD, 8AEE, 8AGD, (8AGK), 8AGO, 8AGZ C.W., 8AHZ, 8AIO, 8AIS, 8AJW, 8AL, 8AMM, 8AMQ, (8AMZ), 8ANJ, 8ANO, (8ANT), 8AOT, 8AP, 8APB, 8APH, 8ARW, 8AWX, (8AXC), 8AVD, 8BB, 8BBW, (8BC), 8BO, 8BV, 8CF, 8CG, 8CH, 8CS, 8DC, 8DI, 8DR spk. & C.W., 8RT, (8DV), 8FC, 8FK, 8FN, 8FO, 8FT, 8FQ, 8GI, 8HA, 8HP, 8HR, 8HY, (8ID), 8IK spk. & C.W., 8IN, 8JE, 8JQ, 8KM spk. & C.W., (8KK), 8KP, (8KZ), 8LF, 8LQ, 8LX, 8MF, 8MG, 8ML, 8MM, 8MT, 8MZ, 8NI, 8OI, 8PJ C.W., 8PN, 8PT, 8QC, 8QE, 8RQ, (8RU), 8SH, 8SP, 8TJ, 8UK spk. & C.W., 8VM C.W., (8VQ), 8VS C.W., (8VW), (8WY), 8XE, 8XK C.W. & fone, 8XR C.W., 8XU spk. & C.W., 8YG C.W., 8ZA, 8ZD, 8ZE, 8ZG C.W., 8ZL, 8ZR, 8ZV C.W., 8ZW, (8ZY), 9AAC, 9AAW, 9AB, 9ACM, 9AGR, 9AOH, 9AON, 9AWZ, 9BP, 9CA, 9CP, 9DBT, 9DV, 9EQ, 9FG, 9FS, 9HJ, 9HN, 9HR, 9JN, 9KB, 9KC, 9KF, 9M, 9KV, 9LF, 9LQ, 9PV, 9UH, 9UU, 9VZ, 9XAC C.W., 9XI C.W., 9XM spk. & C.W., 9YA, 9YB, 9YI, 8ZB, 8ZJ, 9ZL, 9ZN, Canadian: 3AB C.W., 3BP, (3EI), NSF C.W. & fone, WWV C.W.

2RK BROOKLYN, N. Y.—February 15 to April 13

(1AE), (1AS), (1AW), (1BB), (1BBL), (1CK), (1CM), (1CY), (1DR), (1DQ), (1DY), (1EP), (1EAV), (1EBW), (1FV), (1GY), (1GBC), (1HAA), (1IA), (1JAP), (1JQ), (1MAU), 1OBE, (1OE), (1QM), (1QP), (1RAD), (1RAS), (1RAY), (1VAA), (1WQ), (1XM), (1XT), (1YB), (3ABD), (3ACI), 3ACT, 3AHK, (3AIC), (3ALN), (3BG), (3BH), (3BZ), (3CC), (3DC), (3DH), (3DS), (3EN), (3EV), (3EZ), (3FG), (3GO), (3HG), (3HJ), (3HX), (3IW), (3KM), (3NB), (3OB), 3OU, (3PU), (3SX), (3VV), (3XF), (3ZA), (3ZE), (4AG), (4BY), (4CC), (4DL), (4DM), (4GN), (4RT), (4XC), (4YA), (4YB), 5DA, 5EJ, 5JD, 5JE, (5XA), (5XH), (5YH), 5ZA, (5ZL), 5ZP, (8AL), (8ACF), (8ACY), (8ADE), (8AJD), (8AGK), 8AGO, (8AIO), (8AJW), (8AKH), 8ANJ, (8ANT), (8AWX), (8AXG), (8AYN), (8BC), (8BO), (8BP), (8CB), (8DC), (8DI), (8DP), (8DR), (8DV), (8FK), (8FT), (8FQ), (8GI), (8GX), (8HP), (8HR), (8HY), (8ID), (8IK), 8IN, (8JJ), (8JL), (8JS), (8JE), (8KK), (8KO), (8KP), (8KZ), (8LF), (8ML), (8MM), (8MT), (8NI), (8OJ), (8OZ), (8PN), (8QJ, (8QM), (8RQ), (8RU), (8SH), (8SP), 8TN, (8TY), 8VW, 8WV, (8WY), (8XE), 8XH), (8XK), (8XU), (8YW), 8ZA, (8ZB), (8ZD), 8ZN, 8ZR, (8ZW), (8ZY), (8ZZ), (9AAC), (9AAO), (9AAV), (9AAW), (9ABL), (9ACJ), (9AD), (9AEQ), (9AFB), (9AGR), 9AHO, (9AJI), (9AKC), (9AMZ), (9ANV), (9AT), (9AU), (9CA), (9CD), (9CN), (9CP), (9CS), (9DV), (9EL), 9FF, (9FG), 9FJ, (9FN), (9FU), (9GC), (9GN,) 9GP, (9HG), 9HJ, (9HN), (9HR), (9HT), (9HY), (9JN), (9KB), (9KF), (9KO), 9XM, 9XW, (9ZJ), (9ZN), (9ZQ), 9ZT, (9ZV), 9ZX, (NSF) C.W. & fone, (WWV), XF1, Canadians (3BP, (3EI).

2AOS, MONTCLAIR, N. J.

1CK, 1CY, 1CZ, 1IA, 1JQ, 1OE 1TS, 1YB, 1XM, 1BAB, 1BAO, 1BBL, 1HAA, 1HBZ, 1GBC, 1MAD, 1AW, 3AB, 3AD, 3BG 3BZ 3CK, (3CV), 3DH, 3DS, 3EN 3FJ, 3GO 3HG, 3HJ, 3IW 3KM, 3NB, 3OU, 3PS 3PU 3TN, 3VV 3YV 3LY 3ABG, 3ACM, 3ALN 3XF 4AG 4AL, 4BY, 4CK, 4FD, 8AD, 8AL, 8BC, 8BO, 8CD, 8CF, 8DR 8DZ, 8EK, 8FA, 8FQ, 8FK, 8GB, 8HG, 8HY, 8ID, 8IG, 8IK, 8IN, 8JJ, 8JL, 8KE, 8JE, 8KK, 8KM, 8KP, 8KT, 8KZ, 8FT, 8LF, 8LO, 8LU, 8LX, 8MF, 8NI, 8PI, 8PT, 8OZ, 8QJ, 8RW, 8RU, 8RQ, 8TN, 8TT, 8VQ, 8WY, 8XE, 8XQ, 8XU, 8YN, 8ZA, 8ZD, 8ZE, 8ZL, 8ZW, 8AAZ, 8AAU, 8ACF, 8ADQ, 8ADZ, 8AGK, 8AGO, 8AGZ, 8AJU, 8AKJ, 8AMQ, 8AMZ, 8AVD, 8AXC, 8TK, 9AG, 9BP, 9GP, 9KR, 9KV. 9ME. 9OE, 9PC, 9UH, 9UU, 9WE, 9ZN, 9AAW, 9ANC, 9AWL, NSF, XB1 C.W., XFT C.W., BH1. Phones:—(2RF), (2GF), 2IA, 2JZ, 2MC, (2QO), 2QR, 2RB, (2RU), 2XB, 2XK, 2XJ, 2XX. 2XAC, 2ZM, 2ZD, 2ABZ. 2ACI. 2AJF, 2AKO, 2ANX, (2BGM), 2BIV, 2BND, 8XK, WGAD.

2TT, NEW YORK CITY.

1AW. 1BBL, 1CBT, 1CK, 1CY. 1CZ, 1DAK, 1DY, 1EBW, 1BC, 1GBT, 1HAA, 1IA, 1JAP, 1JQ, 1OE, 1VAA. 1WA, 1WQ, 1XM, 1YB, 2AR. 2OA, 2SZ, 2XQ, 3ABG. 3ACM. 3AHK. 3AK. 3ALN, 3AQ, 3AS, 3BZ, 3DH. 3XM, 3DS. 3EN, 3FW. 3GO, 3GX, 3HJ, 3MX. 3IW, 3KM. 3KV. 3LY. 3NB. 3OU. 3PU, 3VV, 3XF. NSF. WWV, XF1, 4XB C.W., 4XC, 4YA, 5XA. 8AAV, 8AAZ, 8ACF, 8AGB, 8AGD, 8AGK, 8AGO, 8AMZ, 8AIB, 8AIO, 8AJW, 8AL. 8ALY C.W. (QRA? QSC terrible) 8AXC, 8BC, 8BO, 8CD, 8CF, 8DR, 8EV, 8FK, 8FQ, 8FT. 8GO, 8GM, 8GW, 8HG, 8IB C.W., 8ID. 8IK spk. & C.W., 8JL, 8KF, 8KK, 8KM, 8KP, 8KZ. 8LF, 8LQ, 8MG, 8ML, 8MM, 8NZ, 8OE. 8OI. 8OZ. 8PU. 8QR, 8RQ. 8RU. 8SP, 8VQ 8WY, 8XE, 8XK, 8XU, 8ZA, 8ZD, 8ZE, 8Z C.W., 8ZL, 8ZN, 8ZR, 8ZT, 8ZW spk. & C.W., 8ZY, 9AAW. 9AGR. 9ANY. 9AWZ. 9DV, 9EL. 9GP, 9KF. 9LF. 9LQ. 9MS. 9NQ. 9OX. 9XI C.W. & spk., 9XM C.W. & spk., 9ZJ, 9ZL, 9ZN, Canadian 3EI.

2RM BROOKLYN, N. Y.—Feb. 17 to April 5.

1AE. 1AW. 1BBL, 1CK, 1CM. 1CY, 1CZ, 1DR, (1DY), 1EBW, 1GM (1GBC), 1GBT, 1HAA (dalite) 1HAF, 1JAP, 1LAX, 1LWU, 1MX, 1MAD, (1OE), 1QP. 1QT. (1RAD), 1RAS, 1RAY, 1VAA, 1XM, (1YB), 2DA. fone? 2FG. 2OA, 2SZ. 2UA, 3CC, 3CK. 3EN. 3FG, 3GO, 3HG, 3HJ, 3HX. 3JR, 3ML, 3OU. 3XF, 4DJ, 4FD, 4XC. 4YA. 8AD, 8AL, 8AAV, 8AEE. 8AGK, 8AGO, 8AHZ, (8AIO), 8AMF. 8AXC, 8BC. 8BO, 8DC. 8DG. 8DR. 8EV. 8ETX, 8FK, 8FQ, 8FT. 8GO, 8GW, 8GX, 8HG, 8IB C.W., 8ID, 8IV C.W., 8JE, 8KK. 8KP. 8KZ. 8LF, 8LQ, 8LV, 8LX, 8MF, 8MG, 8MH. 8MM. 8MR, 8MZ. 8NG, 8OI, 8OZ, 8QJ. 8RG. 8RQ. 8RU, 8SP, 8TK, 8TN, 8TT, 8UK, 8VQ. 8WY. 8XK. 8XQ, 8YN, 8ZD, 8ZE, 8ZG C.W., 8ZR. 8ZV C.W., 9AP, 9AAW, 9AEQ, 9AGR, 9AON. 9CA. 9GN, 9GP, 9HD, 9HN, 9JN, 9JQ, 9KL 9LF, 9LQ. 9PK. 9UH. 9UU, 9WU, 9XM C.W., 9ZB, 9ZJ, 9ZN. NSF, XF1.

3QF, ARDMORE, PA.

1AW, 1CF C.W., 1CK, (1EBW), 1BC. 1GBT, 1HAA, (1IA), 1JAP. 1MAD. (1OE). 1PAW. (1SBZ), 1TS. (1UD), (1XM), (1YB), 2BG, 2BK, 2DA. 2DK, 2DN. 2FG, (2JU), (2OA). 2RK, (2SZ). 2TUQ. 2XQ, (3ACS), (3AFE). 3BZ, (3DH). 3EN, (3GO), (3IW), (3KN). 3NB, 3PU, 3QE, (3QW). 3VV, (3XF), 3ZL, 3ZV, 4AG, 4AU. 4CK. 4EY. 4MI. 4XC. 4YA. 4YB, 5XA. 5YH. 5YHA. 8AAZ. (8ABZ). 8AD. 8ADY C.W., 8AEE. (8AGK), (8AIO). 8AJW. 8AKV. 8AL, (8AMZ). 8ANF. 8AU. 8AYY. (8AXC). 8AXK, (8BC). 8BO, 8CD. 8DC. (8EV). 8FE, 8FK, 8FN, 8FQ. (8FT). 8GX. 8HG. 8HY. (8ID). 8IN, 8JE, (8JL). (8KK). (8KM). 8KP. (8LX). 8MF. 8MH, 8ML. 8MM. 8MR. (8OH). 8OJ. 8OZ. (8PN). 8QE, (8RQ). (8RU). 8SG. 8SP. (8TN). (8TT). (8TY), 8VQ. 8ZA, 8ZN, 8ZR, 8ZW, 8ZY, 9AAC. 9AAF, 9AAW. 9AAZ. 9ANV. 9AON, 9AWY. 9AWZ, 9BP, 9CA. 9CP, 9EQ. 9GP. 9HM. 9HT. 9KB. 9KF. 9KL, 9LQ. 9LR. 9NQ, 9OE, (9OX). 9PV. 9UF. (9UH), 9UU. 9ZB, 9ZE. 9ZL, 9ZN. NSF XF1, XK1. Canadian 3BP, (QSA VY), 3EI. All on one bulb.

3AIC, READING. PA.

(1BZ), 1FV. 1IA, (1OE), 1QP. 1RZ, 1TS. 1XE C.W., 1YB. (1EAV). (1GBC). (1HAA), 1IAT, 1MAD. 1MAW. 1NBS. 1RAY. 2BB. 2DA. (2EL), 2JU. 2OA. 2SZ. 2XQ spk. & fone. 2ZM. 2BGR, 3AW. 3BG, 3BZ, 3CC, 3DH. (3EI). 3EN. 3FJ, (3FR), 3GO, 3XM, 3YE. 3ZA. 3ACS. 3AHK. (XF1), 4AU. 8AR. 8BC. 8BG. 8BO. (8CH). 8HA. 8HY, 8JQ. 8KK. 8KP. 8MF. 8MN. 8RQ. 8SH. 8SP. 8WY.

8XE, 8ZL, 8ZW, 8ZX, 8ZY, 8AEE, 8AGD, 8AGK, 8AKV, 8AMZ, 8ANJ, 8APB, 8ARW, 8AWX, 9EQ, 9KF, 9LC, 9LQ, 9ZQ.

3AGF, BRIDGETON, N. J.

1AW, 1BAB, 1BBL, 1CG, 1DY, 1EP, 1FU, 1GBC, 1GBT, 1HAA, 1HO, 1JAP, 1MAD, 1NBS, 1OBE, 1OE, 1OY, 1QP, 1RAY, 1RZ, 1TS, 1VA, 1WQ, 1XM, 1XT, 1YB, 2AQF, 2BB, 2BM, 2CC, 2CI, 2CM, 2DA, 2DN, 2DR, 2EL, 2FG, 2JR, 2JU, 2KR 2OA, 2OM, 2RB, 2RK, 2SZ, 2UC, 2UE, 2UK, 2XK, 2XQ, 2XX, 2YB, 2YM, 2ZL, 2ZM, 3AAE, 3AAN, 3AAO, 3AB, 3ABM, 3ACM, 3AK, 3AKE, 3AS, 3ASF, 3BA, 3BE, 3BG, 3DDS, 3DH, 3DR, 3DS, 3EH, 3EL, 3EN, 3GO, 3GX, 3HG, 3HJ, 3IC, 3KKM, 3NB, 3OB, 3OU, 3OW, 3PB, 3PU, 3QF, 3SM, 3SZ, 3UC, 3UQ, 3XI, 3XM, 3YK, 3ZA, 3ZG, 4AL, 4YB, 5DA, 5XA, 8ACF, 8ADQ, 8AEE, 8AGK, 8AGO, 8AHU, 8AIO, 8AKJ, 8AL, 8AMM, 8AMZ, 8AOT, 8AP, 8ARK, 8ARW, 8AVL, 8AXC, 8AYA, 8BC, 8BO 8BT, 8BV, 8CG, 8DT, 8FC, 8FK, 8FO, 8FP, 8FQ, 8GI, 8HR, 8IL, 8IN 8JQ, 8KM, 8KZ, 8LY, 8LQ, 8MF, 8ML, 8MM, 8NI, 8QE, 8RP, 8RQ, 8RU, 8SH, 8SP, 8TT, 8TY, 8VW, 8WY, 8XA, 8XE, 8XK, 8XU, 8ZA, 8ZD, 8ZE, 8ZG, 8ZL, 8ZQ, 8ZV, 8ZW, 9AAC, 9AAW, 9AWX 9FJ, 9LQ, 9RP, 9XM, 9YB, 9ZJ, 9ZL, 9ZN, 9ZW.

XF1, WING RADIO STATION, LANGLEY FIELD, VIRGINIA.

1AW, 1BBL, 1CF C.W., 1CY, 1CZ, 1HAA, (1OE), (1QR C.W.), 1WQ, 1XM, 2ARA, (2BK), 2DA, 2DN, 2DR, 2EL, 2JU, 2LN, 2OA, 2RK, (2SZ), 2UK, 2XK, (2XX), (2ZL C.W.), 2ZM C.W., (3AAE C.W.), 3AD, 3ALN, 3CC, 3DH, 3IW, (3NB), 3PU, 3XQ, 4CK, (4CX), 4DJ, 4HT, (4XB C.W.), 4XC, (4YA), (4YB), 5ER, 5XA, (5XB C.W.), 8AGK, (8AGZ C.W.), 8AMZ, 8AIO, 8AL, 8AXC, 8AZ, 8BC, 8BU, 8CF, 8DC, 8DP, 8DZ, (8FA), (8FT), 8GX, 8HG, (8IB C.W.), 8ID, (8IX), 8JL, 8JQ, 8KK, (8KM C.W.), 8KP, 8KQ, 8LJ, 8LV C.W., 8OJ, 8ON, 8PJ, 8QJ, 8RQ, 8RU, 8TT, 8VQ, (8VS C.W.), 8XC, 8XE, 8XU, 8ZA, 8ZD, 8ZG C.W., 8ZL, 8ZQ, 8ZR, 9AAW, 9AU, 9EQ, 9FG, 9GP, 9KV, (9OX), 9SU, 9WW, (9XI C.W.), 9XM C.W., 9YB, 9ZJ, 9ZN.

4YA, ATLANTA, GA.

2RK, 2EL, 3ALI, 3DH, 3EN, (3GO), (3IW), 3XP, (3YK), (XF1), 3XP, 4AC, (4AG), 4BK, (4BY), 4EY, (4FD), (4GN), 4XB fone & C.W., 4YE, 5BM, 5DA, 5EH, 5EW, 5HL, (5HW), 5IB, 5IF, 5JA, (5JD), 5LS, 5MC, 5MY, (5XA), 5XC, 5YE, (5YH), 5ZA, 5ZAB, 5ZK, 5ZX, 8AAW, 8AGK, 8CD, 8DC, 8FT, 8IK spk. & C.W., 8KD, 8KK, 8KM, 8KP, 8PN, 8RQ, 8TT, 8XE, 8ZA, 8ZJ, 8ZL, 8ZW, 8ZY, 9AAC, 9AAG, 9ACN, 9AIZ, 9AO, 9AON, 9AP, 9ARG 9CA. 9CP, 9EL, 9EQ, 9GY, 9LF, 9LQ, 9MC, 9MMC, 9NQ, 9OE. (9OX), (9PS, dalite), 9RQ, 9TV, 9UU, 9VZ, 9XM, 9YA, 9YM, 9YN, 9ZA, (9ZB), 9ZD, 9ZN.

4DL, WEST PALM BEACH, FLA.

1AA, 1AW, 1DA C.W., 1DY, 1HAA, (1HAB), (1JAP), 2DR, 2EL, 2RB, 2RK, 2RL, 2ZL C.W., 3BQ, 3EM, 3EN, 3HX, (3HJ), 3KM, 3VV, 4AG, (4AM), 4AQ, (4BY), 4CD, 4CK, 4CG, 4EY, (4FD), (4GN), 4XA, 4XC, 4YA, (4ZC), 5DA, 5HR, 5HW, 5XA, 5YH, 5ZP, 8AGK, 8AG, 8DR, 8ID, 8JE, 9MX, 9HI, 9CA, 9OK.

4EC, WILMINGTON, N. C.

1AE, 1AW, 1BBL, 1DA, 1DN, 1DY, 1GBT, 1HAA, 1MAD, 1QP, 1ME, 1RAY, 1RU, 1UN, 1XM, 1YB, 1YK, 2AAE, 2AJE, 2AR, 2AB, 2ALK 2AYR, 2BGM, 2BK, 2BM, 2BQ, 2DN, 2DR, 2EL, 2FG, 2HA, 2JZ, 2KY, 2PL, 2QR, 2RK, 2UC, 2UK, 2XF, 2XQ, 2XX, 2YM, 2ZC, 2ZL, 2ZM, 3AAG, 3ACE, 3AC8, 3ACS, 3AHK, 3AHW, 3AIC, 3BG, 3DB, 3DF, 3DH, 3EN, 3FG, 3GO, 3HG, 3HJ, 3KM, 3PU, 3VV, 3XF, 3YE, 3YG, 3YK, 3ZM, 4AG, 4AM, 4AN, 4AU, 4BK, 4BY, 4CG, 4CK, 4DZ, 4EK, 4FD, 4GL, 4GN, 4XB, 4XC, 4YA, 4YB, 4ZC, 5DA, 5ER, 5JE, 5XA, 5YE, 5YH, 5YI, 5ZAB, 5ZE, 8AAZ, 8ACF, 8AGK, 8AGO, 8AIO, 8AL, 8AMQ, 8ANJ 8APB, 8ARW, 8AWX 8AXC, 8BD, 8CF, 8DP, 8DR, 8DZ, 8FAA, 8FG, 8GB, 8GQ, 8GW, 8HG, 8IK, 8IS, 8JE, 8JQ, 8KK, 8KP, 8LH, 8LY, 8OP, 8QJ, 8RG, 8FQ, 8RW, 8SH, 8SP, 8UO, 8VQ, 8XA, 8XE, 8XH, 8XK, 8XS, 8XU, 8ZA, 8ZD, 8ZE, 8ZL, 8ZR, 8ZT, 8ZV, 8ZW, 8ZY, 8ZZ, 9ASJ, 9AMT, 9AWX, 9DC, 9EQ, 9HY, 9KR, 9LA, 9LQ, 9OX, 9UK, 9UT, 9UU, 9WO, 9WY, 9XF, 9XM, 9YB, 9YI, 9ZD, 9ZJ, 9ZL, 9ZN.

5ZA, LOUIS FALCONI, ROSWELL, N. M.

2RK, 2ZL C.W., 3DH, 4XC, 5AI, 5AO, (5BI), 5BM, 5BO, (5BW), (5CA), 5CC, 5CD, (5CG), (5CI), 5CL, (5DB), (5DD), (5DW), (5EA), (5EF), (5EJ), 5FA, 5FL, 5HA, (5HF), (5HL), (5HV), (5IB), 5IC, (5IF), (5IS), 5JA, (5JE), (5JS), (5JX), 5KA, (5LR), (5MF), 5XA, (5XB spk. and C.W.), (5XD), 5YE, (5YH), (5ZC), 5ZD, (5ZF), (5ZG), 5ZK, (5ZL), (5ZP), (5ZR), 5ZS, (5ZT), (5ZU), 5ZV, (5ZW), (5ZX), (5ZZ), 6AE, (6AK), 6BA, (6BJ), 6BM, (DF), (6DP), (6EB), (6ED), (6EF C.W. & fone), (6EJ), 6EL, (6EN), (6ER), 6FA, 6FI, 6FS, (6GE), 6GF, (6GI), (6HH), (6HY), (6IF), (6IG), (6JD), (6JJ), (6JM), (6JT), (6KA), (6KP), (6MK C.W.), 6MZ, (6OC), (6PQ), (6SK), 6TL, (6TX), (6WH), (6WV), 6XM, (6XZ), (6ZA), (6ZB), 6ZC, 6ZE, (6ZH), 6ZK, (6ZL), (6ZM), (6ZN), (6R), (6AAK), (6ABP), (6ABW), (6ADL), 6AMP, 6ADX, 7CC, (7DA), (7DH), 7EX, 7FL, (7IM), 7IN, 7KX, 7LU, (7YA), (7ZJ), 8ML, 8ZL, 8ZR. (8ZY), 9AK, (9BW C.W. and buzzer), (9CA), 9DU. (9EE), (9EL), (9EQ), (9FB), 9FK, 9FP, (9HI), (9HN), 9HM, (9HT), (9IF), (9JN), (9JQ), (9KV), (9LC), 9KO, 9LE, (9LR), 9LW, 9MS, 9NQ, (9OE), (9OR), (9PI), 9PS, 9PV, 9QM, 9RG, (9RY), (9TI), (9UT), 9UU, (9WI), (9WU), (9WW), 9XI C.W., 9XT, (9XM), 9YA, (9YI), (9YM), (9YW), 9YY, (9ZB), 9ZC, (9ZJ), 9ZL, (9ZN), (9ZT, 9ZG, 9ZL, (9ZV), (9ZX), (9ABX), 9AAJ, 9ABI, 9AED, (9AEG), 9AEP, 9AEQ, 9AEU, 9AEZ, 9AEY, 9ACV, (9AMB), 9AMR, (9AFX), 9ALG, 9AJD, 9AON, 9APC, 9AVQ, (9AUO), NSF C.W. buzzer, fone.

L. W. HATRY, PORT ARTHUR TEXAS—March.

4AG, 4DJ, 4XA fone, 4XC, 4YA, 5CA, 5EK, 5EW, 5FL, 5HL, 5HV, 5IB, 5IF, 5JD, 5JE, 5JI, 5MO, 5MY, 5XA, 5XB C.W. spk., 5YE, 5YH, 5YI, 5ZA, 5ZAA, 5ZAB, 5ZC, 5ZE fone, spk., 5ZF, 5ZL, 5ZP, 5ZR, 5ZS, 5ZT ZZU, 5ZW, 5ZX, 6WV C.W., 8AEE, 8AIO, 8DC, 8EB, 8HG, 8IK, 8KP, 8XK I.C.W., 8YG C.W., 8ZG C.W., 8ZL fone and spk., 8ZY, 9AAC, 9AAG, 9AAW, 9ABL, 9AEG, 9AEQ, 9AEY, 9AFX, 9AHS, 9AIZ, 9ALG, 9ANV, 9ANP, 9AOH, 9AON, 9AOX, 9AP, 9ARJ, 9ARP, 9ATF C.W., 9AVO, 9AV, 9AZN C.W., 9AZX C.W., 9BW, 9CA, 9CP, 9DE, 9DIW, 9DV, 9EL, 9FU, 9HI, 9HM C.W. spk., 9HN, 9HT, 9JA, 9JG, 9JN, 9JQ, 9KF, 9KV, 9LC C.W. and spk., 9LF, 9LR, 9MC, 9NQ, 9OE, 9OX, 9PS. 9PV, 9QO, 9RY, 9TI, 9UF, 9UK, 9UT, 9VZ, 9WI, 9WU, 9XI C.W., 9XM, 9YA, 9YM, 9ZAC, 9ZL, 9ZN, 9ZV, XF1 C.W., NSF I.C.W. and fone.

5JY, DALLAS, TEX.

(5AI), 5AJ, (5AU), 5BV, 5BJ, 5BI, 5BM, (5CE), (5C), (5CI), (5DW), 5EA, 5ER, 5ES, (5EW), 5EL, 5FE, 5FB, 5FA, (5GU), (5HF), 5HU, (5HV), 5IB, 5IC, (5IE), 5IF, (5IH), (5IS), 5JA, 5JD, (5JG), (5JL), (5JU), 5JE, (5KK), (5LC), (5LR), 5LS, (5LT), 5ME, 5MR, 5MC, 5MF, (5MM), (5ML), 5NG, (5NC), 5XA, 5XB, (5XG), 5XJ, 5YH, 5YE, 5ZA, (5ZC), 5ZF, (5ZG C.W. & spk.), 5ZL, 5ZP, 5ZU, 5ZW, 5ZX, 8CO, 8KP, 8HG, 8KK, 8MR, 8AKV, 9AAC, 9AAV, 9AEY, 9AWO, 9AEQ, 9AEG, 9AFX, 9AON, 9AOU, 9BW, 9CA, 9EL, 9FF, 9FU, 9HI, 9HT, 9JA, 9JN, 9LA, 9LR, 9MM, 9NQ, 9OE, 9QO, 9UT, 9WU, 9WN, 9WW, 9XM C.W., 9ZL, 9ZQ.

6QR, RENO, NEVADA.

5ZA, 6AAD, 6AAK, 6AAW, 6ABM, 6ABP, 6ACA, 6ACR, (6ACY), (6ADL), (6ADQ), (6AFN), 6AFW, 6AFY, (6AGF), 6AID, 6AJH, (6AJR), 6AJX, 6AKH, 6ALA, (6ANK), 6AOR, (6AE), (6AH), (6AK), (6AR), 6AT, 6BB C.W., 6BX C.W., (6CH), (6CZ), 6DA, (6DP), (6EA), (6EB), (6ED), (6EF fone & C.W.), 6EJ, (6EN), 6ER, (6EX), 6FH, 6FI, 6FT, 6GI, (6GP), 6GR 6GY, (6HC) (6HH), 6HY, 6IC, 6ID, (6IF), 6IG, 6IR, (6IS), 6IT C.W., 6IV, 6JI, 6JM, (6JR), 6JT, (6KA), 6KI, 6KL, 6KM, (6KP), (6KS), 6LC, 6LU, 6MH, 6MK, 6MZ,

(6OC), 6OH, (6OL), 6OT, 6OW, 6PC, 6PQ, 6PR, 6QS, (6QY), (6RN), 6RU), (6SK), (6TL), 6TO, 6TV, 6UK, 6VX, 6WH, (6XZ), (6ZA), (6ZH), 6ZK, 6ZM, (6ZN), (6ZO), 6ZR, (6ZU), (6ZY), (7AD), (7BC), (7BH), (7BJ), 7BK, (7BP), (7BQ), 7CE, (7CU), (7CW), 7DH, (7DS), 7ED), 7EX, (7FI), (7FL), 7GA, 7GI, 7HN, 7ID, (7IN), (7JW), 7JX, 7LN, 7LU, 7LY, 7MB, 7NN, (7YA), 7YS, 7ZG, (7ZI), (7ZJ), (7ZM), 9YW.

RAYMOND ZIMMERMAN, 2318 K ST., SACRAMENTO, CAL.

5ZA, 6AE, 6AF, 6AG, 6AH, 6AJ, 6AK, 6AL, 6AN, 6AO, 6AR, 6AT, 6BA, 6BJ, 6BM, 6BN, 6BP, 6BQ, 6BR, 6CC, 6CF, 6CH, 6CL, 6CO, 6CP, 6CR, 6CV, 6DA, 6DH, 6DK, 6DP, 6DW, 6DY, 6EA, 6EB, 6EC, 6ED, 6EJ, 6EK, 6EN, 6EP, 6ER, 6EX, 6FB, 6FE, 6FH, 6FI, 6FJ, 6FT, 6GF, 6GI, 6GR, 6GX, 6HH, 6HY, 6JA, 6JC, 6JD, 6JI, 6JJ, 6JN, 6JR, 6JT, 6KA, 6KM, 6KP, 6LO, 6LT, 6NC, 6NH, 6NL, 6NY, 6OC, 6OH, 6OL, 6OM, 6OT, 6OW, 6OX, 6PH, 6PJ, 6PM, 6PQ, 6PR, 6QL, 6QN, 6QR, 6RP, 6RQ, 6RT, 6SK, 6SR, 6SU, 6TC, 6TF, 6TV, 6TX, 6UM, 6VQ, 6WG, 6WJ, 6WZ, 6XZ, 6ZA, 6ZB, 6ZH, 6ZJ, 6ZK, 6ZM, 6ZR, 6MZ, 6CZ, 6IC, 6ID, 6IG, 6IK, 6IP, 6IF, 6IR, 6IU, 6TL, 6VM, 6ZO, 6AF, 6IY, 6IQ, 6IL, 6GM, 6SG, 6IM, 6GA, 6DJ, 6TO, 5LL, 6IV, 6GP, 6BH, 6AAB, 6GH, 6AAF, 6AAG, 6AAK, 6AAJ, 6AAM, 6AAT, 6AAW, 6ABK, 6ABM, 6ABP, 6ABT, 6ABW, 6ABX, 6ACA, 6ACB, 6ACF, 6ACL, 6ACM, 6ACP, 6ACW, 6ACY, 6ADL, 6ALW, 6AEA, 6AFN, 6AFD, 6AGA, 6AGF, 6AGP, 6AIL, 6AIM, 6AIN, 6AIW, 6AJH, 6AJT, 6ADA, 6ADX, 7AD, 7DA, 7CU, 7CC, 7CW, 7IN, 7BP, 7GO, 7GY, 7BQ, 7ZI, 7DF, 7ED, 7CQ, 7HN, 7IU, 7ZJ, 7DQ, 7YA, 7BA, 7ZH, 7LW, 7HS, 7BH, 7LU, 7CN, 7EX, 7GA, 7HD, 7CE, 7KB, 7LN, 7BJ, 7BR, 7DH, 7FB, 7BK, 7DS, 7ZK, 7GK, 7BC, 7FH, 7FI, 7IX, 7LY, 7FL, 7KX.

6BF, SANTA PAULA, CAL.

5EA, 5IF, 5ZA, 6AAH, 6AAK, 6AAT, 6AAY, 6ABM, 6AC, 6ACA, 6ACM, 6ACR, 6ACS, 6ACY, 6ADA, 6ADU, 6AE, 6AEF, 6AER, 6AEW, 6AF, 6AFN, 6AFU, 6AGC, 6AGF, 6AGH, 6AHB, 6AHQ, 6AID, 6AIK, 6AIL, 6AIT, 6AIW, 6AJT, 6AJV, 6AK, 6ALU, 6AOM, 6AR, 6AT, 6AY, 6BX C.W., 6CC, 6DD, 6DF, 6DK, 6DP, 6DR, 6EA, 6EB, 6EC, 6ED, 6EF, 6EJ, 6EN, 6EP, 6ER, 6EW, 6EX, 6FH, 6FI, 6FR, 6FS, 6GP, 6GR, 6GY, 6HH, 6HX, 6IF, 6IY C.W., 6IZ, 6JD, 6JE, 6JF, 6JM, 6JT, 6KA, 6KI, 6KM, 6KN, 6LC, 6LE, 6LT, 6LX, 6MK, 6MZ, 6OC, 6OH, 6OL, 6OP, 6OW, 6PE, 6PQ, 6PR, 6QR, 6QS, 6SK, 6TC, 6TG, 6TH, 6TV, (6VZ), 6XZ, 6ZA, 6ZE, 6ZH, 6ZK, 6ZN, 6ZR, 6ZS, 6ZT, 6ZU, 6ZX, 6ZY, 7FI, 7HN, 7IN, 7ZG.

6AE, STANFORD UNIVERSITY, CAL.

5ZA, 6ADL, 6AID, 6EB, (6ED), 6EN, 6ER, 6GP, (6ID), (6IG), (6IS), 6JT, (6KA), 6OT, 6PR, 6QR, (6RN), 6XZ, (6ZA), 6ZH, 6ZM, (6ZN), 7BC, 7BJ, 7BK, 7BP, 7BQ, 7DH, 7FI, 7FL, 7IN, (7LN), (7YA), 7YS, 7ZK, 7ZJ, 9YW, Canadian 5BA.

6ED, SANTA ANA, CAL.

5IF, (5ZA), (6AE), 6AH), (6AK), (6AN), (6AR), (6AS), 6AT, 6BB, 6BJ, 6BN, 6BQ, (6BX), 6CO, (6CP), 6CS, (6CV), (6DK), 6DH, 6DP, (6EJ), (6EX), (6FH), 6FI, 6FN, (6HH), (6IC), 6IV, 6IY, (6JJ), (6JR), (6JT), (6KL), (6MZ), (6NH), (6OC), (6OH), 6OT, (6OW), (6PR), (6PW,) (6QR), (6QS), 6WZ, 6XW, (6XZ), 6ZA, (6ZB), 6ZE, (6ZH), (6ZK), 6ZM, (6ZN), (6ZO), 6ZR, 6AAB, 6AAK, (6ACM), (6ACR), (6AGF), (6AJT), (6AJH), 6AIK, 6AIW, 7AD, 7AF, (7BT), 7BK, (7BP), 7GI, (7BQ), (7CC), 7CE, (7CU), 7CW, 7DA, 7DK, (7DS), (7ED), 7EX, 7FL, 7FI, 7FN, 7FX, 7GO, 7YA, 7YB, 7ZB, 7ZG, (7ZI), 7ZR, 7IM, (7IN), (7ZJ), 7FX, 9AEQ, 9WU, 9OE, 9RR (?) 9YW, 9ZN.

6VS, OGDEN, UTAH,—February.

5ZA, 6AD, 6AH, 6AK, 6AN, 6AT, 6BA C.W., 6BQ, 6CV, 6DK, 6DP, 6DW, 6EA, 6EB, 6ED, 6EJ, 6EN, 6ER, 6GF, 6HH, 6IF, 6IG, 6JD, 6JJ, 6JR, (6JT), 6KP, (KDEH), 6MK, 6NQ, 6OH, (6OT), 6PE, 6PQ, 6PR, 6QR, 6SJ, 6UK, 6XZ, (6ZA), (6ZH), 6ZK, (6ZM), 6ZN, 6ZP, 6ZR, 6ZS, 6ZU, 6ZX, 6ABM, 6ABP, 6ACA, 6ACD, 6ACR, 6AFN, 6AFD, 6AGF, 6AIL, 6AIW, 6AJT, 7AD, 7AN, 7BC, 7BK, 7BP, 7BQ, 7BR, 7CC, 7CU, 7CW, 7DA, (7DH), 7DR, 7DS, 7DV, 7EX, 7FB, 7FH, 7FI, 7GA, 7GQ, 7IF, 7IM, 7IN, 7JR, 7KK, (7KX), 7LE, 7LN, 7LU, 7LW, 7LY, 7MO, 7MB, 7OH, 7XB, 7YA, 7ZA, 7ZG, 7ZH, 7ZI, 7ZJ, 9EL, 9HI, 9IF, 9LW, 9PI, 9QO, 9UT, 9WI, 9YW, 9ABX, 9AID, 9AIF, 9ASF, 5DCG.

7HN, EUGENE, OREGON,—Feb. to March 11.

6AN, 6AK, 6EC, 6EA, 6CO, 6CU, 6DP, 6ER, 6EJ, 6FI, (6FH), 6GF, 6GN, 6GU, 6IC, 6ID, 6IF, 6IK, 6IY, 6GP, 6JM, 6KM, 6LK, 6MZ, 6OC, 6OH, 6OW, 6KP, 6PR, 6QS, 6TC, 6VX, 6ZK, 6ZH, 6ZR, 6AAE, 6AAD, 6AAK, 6ACA, 6AID, 6AAW, 6AFN, 6AFM, (6AGF), 7AD, 7BC, 7BK, 7BQ, 7CB, 7CC, 7CW, 7I, 7FL (7IY), 7IU, 7LU, 7LS, 7YS, 7IN.

7LN NAMPA, IDAHO.

5IF, 5ZA, 6AC, (6AE), 6AK, 6BX C.W., 6CV, 6DD, 6DH, 6DK, 6DM, 6DO, (6DP), 6EA, 6EB, 6ED, 6EJ, 6EN, 6ER, 6EX, 6FH, (6GF), 6GY, 6HH, (6IC), 6IG, 6IV, 6IY C.W., 6JM, 6JR, 6KA, 6KM, 6LA, 6LB, 6LC, 6LH, 6LK, 6LR, 6LT, 6LX, 6MK, 6MZ, 6OH, 6OW, 6PO, (6PR), 6QR, 6RN, 6SK, 6TC, 6TO, 6UK, 6UM, 6VH, 6WV C.W., 6XL, 6ZA, 6ZB fone, 6ZH, 6ZK, (6ZP), 6ZR, 6ZS, (6ZU), 6ZX, 6Y, 6AAK, 6ABM, 6ABP, 6ABX, 6ACA, 6ACD, 6ACR, 6ADA, 6ADL, 6AFN, 6AGF, 6AGU, 6AID, 6AJT, 6AJK, 6AOM, 7AD, 7BC, 7BH, 7BJ, 7BK, (7BP), 7BQ, 7BZ, 7CB, 7CM, 7CU, 7CW, (7ED), 7EX, 7FG, 7FI, 7FL, 7FO, (7FT), 7GA, 7GI, (7HJ), 7HS, 7IN, 7IY, 7JR, 7KX, 7LM, 7LU, 7LY, 7NN, 7OF, 7XB, (7YA), 7YS, (7ZG), 7ZI, (7ZJ), 7ZK, 7ZM, 9BW, 9EE, 9EL, 9LR, 9LW, 9PI, 9WI, 9WU, 9WV, 9AFJ, 9AFX, 9AID, 9AIW, 9ARJ, 9ASR, 9AWD, 9XAE.

CHAS. F. BURDICK, CASPER, WYO.

5BM, 5EW, 5HD, 5HF, 5HL, 5IB, 5IF, 5IT, 5JS, 5ZA, 6AJX, 6EF, 6EJ, 6IG, 6PU, 6SK, 6VS, 6ZB, 6ZH, 6ZK, 6ZU, 7DH, 7EX, 7FL, 7HS, 7KX, 7LY, 7MO, 7YA, 7ZG, 7ZN, 9AAG, 9AEG, 9AEY, 9AFX, 9AOH, 9AON, 9AOO, 9ASF, 9AUO, 9AVZ, 9BW, 9DB, 9DO, 9DCE, 9DCG, 9DGP, 9DIW, 9DJD, 9EL, 9ET, 9HI, 9HM, 9HN, 9JN, 9LR, 9LW, 9OE, 9PS, 9QO, 9RY, 9SZ, 9TI, 9UT, 9WI, 9WU, 9VAE, 9XL, 9XO, 9ZC, 9ZN, 9ZO.

8GX, OBERLIN, OHIO.

1AW, 1BZ, 1CK, 1OE, 1PG, 1TS, 1XM, 1BAB, 1BBD, 1BBL, (1GBT), (1HAA), 1RAY, (2BK), (2DA), (2DN), 2FG, 2EL, (2JU), (2OA), 2OM, 2PL, 2SZ, (2AER), (2ARD), (2BGH), (3BP), 3BZ, (3DH), 3EN, 3GN, (3GO), (3HJ), (3HG), (3IW), (3KM), 3NB, (3PU), (3VV), (3XF), 3XM, 3ZP, 3AHK, Can (3DH), (3EI), (3BP), (4AG), (4XC), 4YB, 5DA, 5EA, 5JD, 5JE, 5LO, 5SV, 5XA, 5YE, (5YH), 5ZA, 5ZC, 5ZE, 5ZP, 5ZAB, 6KA, 8AY, (8BU), (8CD), 8FE, 8FI, 8FT, 8GW, 8HA, 8HG, 8IB, (8ID), (8IN), (8IZ), 8IW (8JL), (8JP), (8KK), (8KM), (8LM), (8LQ), (8ML), (8RB), (8R), (8RU), (8TN) 8TW, (8TY), 8UK, (8VS), (8WV), 8XE, 8XK, 8XU, 8ZA, 8ZB, 8ZD, 8ZL, 8ZN, (8ZR), 8ZT, 8ZW, 8ZY, 8AAT, 8ABZ, 8AGK, 8AHR, 8AIO, 8AKV, 8AMP, 8AMW, (8AMZ), 8AXC, 8AYL, 8AYN, 8BBC, 8BBW, 9AC, 9AK, 9AV, (9CA), (9CP), (9DC), (9DV), 9EE, (9FF), (9FU), 9GP, 9HI, 9HM, 8HT, 9HY, (9JN), (9KB), 9KF, (9KL), 9KN, 9LA, (9LC), (9LQ), 9LR, 9MS, 9NQ, 9OO, (9OE), (9OX), (9PS), (9PV), (9QJ), 9QO, (9UH), 9UT, (9UU), 9VC, 9WU, 9XA, 9XM, 9YM, (9ZB), 9ZJ, 9ZL, (9ZN), (9AAC), (9AAV), (9AAW), 9ABL, 9ACJ, 9AEG, 9AEQ, 9AEY, (9AFX), 9AGK, (9AHO), 9AJH, (9ANV), (9AOH), 9AOK, (9ARG), (9AWZ), 9DCW, (9DGP).

8NB, ROCHESTER, N. Y.

1CK, 1CY, 1CZ, 1DY, 1GB, 1IA, 1OE, 1OZ, 1QP, 1QR C.W., 1RZ C.W. & spk., 1TS, 1XM C.W., 1YB, 1BBL, 1GAN, 1GBC, 1GBT, 1HAA, 1HAF, 1IAP, 1MAD, 1MAU, 1RAD, 1RAS, 1RAY, 1SBZ, 2AK, 2AR, 2BG, 2BK, 2BM, 2CT, 2DA, 2DI, 2DN, 2DR, 2DS, 2EB, 2EL, 2FG, 2HI C.W., 2JR, 2JU, 2KX C.W., 2NQ, 2OA, 2OE, 2PL, 2RK, 2RL, 2RM, 2SZ, 2UK, 2XK C.W., 2XQ, 2XX C.W. & fone, 2ZC, 2ZL C.W., 2ZM C.W. & spk., 2AER, 2AID,

2ALD, 2ARD, 2AXB C.W., 2BML C.W., 3BP, 3CC, 3DH, 3DP, 3EN, 3FB, 3GO, 3HG, 3HJ, 3NB, 3OU, 3PU, 3XF, 3XM, 3YK, 3AIC, 4CB, 5DA, 5ER, 7CC, 8AL, 8AT, 8BQ, 8BV, 8CD, 8CG, 8DR, 8DV C.W. & spk., 8DZ, 8ED, 8FE, 8FM, 8FQ, 8HJ, 8HP, 8HR, 8ID, 8IK, 8IL, 8IN, 8JQ, 8JU C.W., 8KP, 8KZ, 8LF, 8LQ, 8ML, 8MM, 8MT, 8PI, 8PN, 8PQ, 8PW, 8QR, 8RQ, 8RU, 8RW, 8SH, 8SP, 8TK, 8TN, 8TY, 8VQ, 8WY, 8XE, 8XK C.W. & fone, 8XS, 8XU, 8ZA, 8ZD, 8ZL, 8ZT, 8ZW, 8ACF, 8ADR, 8AFZ, 8AGK, 8AHU, 8AIO, 8AMZ, 8AND, 8ANJ, 8AOT, 8APB, 8ARW, 8AXC, 9AV, 9GP, 9HJ, 9JN, 9KF, 9KV, 9LQ, 9MT, 9OE, 9TV, 9UH, 9YB, 9YI, 9ZL, 9AWZ, 9BBL, NSF C.W. & fone, XF1 C.W., XK1 C.W., WL3, NAI.

8ZG, SALEM, OHIO.—All C.W.

Heard at 8ZG: 1AE, 1QR, 1XM, 1XX, 2CS, 2AJF, 2XE, 2XF, 2XK, 2AXB, 2BB, 2ZM, 3AAO, 3MBL, 4ZB, 4GL, 8IK, 8DR, 8ALY, 8KM, 8ACC, 8LF, 8PJ, 8IB, 8ZL C.W. and voice, 8ZW, 8YG, 9YM, 9ZT, 9AZX, XF1, XB1, NQT, KDKA. 8ZG worked following C.W. stations: 1RU, 2ZL, 3AAE, 8AGZ, 8IB, 8UK, 8VS, 8IB, 9XI, 9XM, 9ATF, NSF. Handled 68 msgs. during March. Longest distance—700 miles, 9XI. (on 10 watts).

8EB, NORWOOD, CINCINNATI.

1AIA, 1AW, 1BBL, 1HAA, 1QN, 1XF, 1XM, 1YB, 2AHK, 2ALN, 2DI, 2DN, 2DR, (2EL), 2EN, 2OU, 2QR, 2RK, 2SZ, 22XX, 3AL, 3BP Canada, 3DH, 3EN, 3GO, (3HG), (3HJ), 3JW, 3KM, 3NB, 3XF, 4AG, 4BY, 4KA, 4XC, 4YA, 4YB, 5DA, 5HL, 5IF, 5JD, (5XA), 5YH, 5ZD, 5ZE, 5ZL, 5ZK, 5ZO, 8AAV, 8AL, 8ADE, (8AGK), 8AGO, 8AIB, 8AKJ, 8AN, 8ANJ, 8AOA, 8ARK, 8ASU, 8BC, 8BF, (8BO), 8BQ, 8BV, 8CD, 8CF, 8CG, 8CV, 8FQ, 8HR, 8IB, 8ID, 8IK, 8JE, (8JJ), 8JL, 8KK, 8KM, 8KZ, 8LH, 8LV, 8MF, 8MM, 8NG, 8NI, 8OI, (8OJ), 8PM, 8QA, (8RQ), 8RU, 8SP, 8TT, (8UK), 8WY, 8XE, 8ZK, 8XS, 8XU, 8YI, 8YN, 8ZD, 8ZN, 8ZR, 9AAG, 9AAW, (9ABL), 9ABZ, 9ACB, 9ACJ, 9ADS, 9AGK, (9ANV), 9AON, 9AOX, 9AP, 9AR, 9ARO, 9AV, 9AWX, 9AWZ, 9BP, 9CA, 9DB, 9DDW, 9DIW, 9DV, 9DW, (9EL), 9EZ, 9FG, 9GP, 9HI, 9HM, 9HN, 9HT, 9JD, 9JQ, 9KF, 9KN, 9KO, 9KV, 9LF, 9LQ, 9LU, 9LR, 9LW, 9MC, 9MS, 9NO, 9NQ, 9OE, 9OO, 9PN, 9PV, 9QJ, 9RY, 9TI, 9TV, (9UF), (9UU), 9VC, 9VF, 9WI, 9WW, 9XI, 9XM, 9ZB, 9ZJ, 9ZN, 9ZV.

8XN, PITTSBURGH, PA.

1AR, 1AT, 1AW, 1BM, 1HAA, 1KN, 1OE, 1QR, 1XM, 2AQ, 2ACM, 2BK, 2CC, 2GO, 2GR, 2GY, 2NC, 2RK, 2WP., 2XM, 2ZL, 2ZR, 3AW, 3AIC, 3CC, 3EN, 3HG, 3NV, 3MI, 3OU, 3XF, 3YK, 4KC, 8AL, 8AP, 8AAJ, 8AAL, 8ABG, 8ABH, 8ACF, 8ACP, 8ACQ, 8AEE, 8AGD, 8AGK, 8AGX, 8AGY, 8AHL, 8AHZ, 8AIF, 8AIN, 8AIO, 8AIU, 8AIV, 8AIX, 8AJC, 8AJM, 8AJT, 8AJW, 8ALD, 8ALV, 8AMM, 8AMQ, 8AMZ, 8ANJ, 8ANZ, 8AOI, 8AOO, 8AOP, 8AOW, 8ARA, 8ARU, 8ASF, 8ATS, 8ATX, 8AWA, 8AXV, 8CI, 8CF, 8CG, 8CU, 8CW, 8DC, 8DQ, 8DR, 8DZ, 8EA, 8ED, 8EH, 8EW, 8FQ, 8FM, 8GI, 8HC, 8HS, 8IN, 8IIQ, 8JQ, 8KI, 8KQ, 8KP, 8LF, 8LH, 8LX, 8MD, 8ML, 8NI, 8NN, NT 8NV, 8OC, 8OO, 8OW, 8PA, 8PL, 8QE, 8QQ, 8RP, 8RQ, 8RU, 8RV, 8SG, 8UK, 8UP, 8UQ, 8VQ, 8VX, 8WD, 8WS, 8XC, 8XH, 8XK, 8XM, 8XU, 8YI, 8ZD, 8ZQ, 8ZR, 8ZV, 8ZZ, 9AP, 9AAW, 9ANV, 9AOH, 9DF, 9ET, 9GP, 9KF, 9KR, 9LQ, 9QR, 9NW, 9UK, 9WE, 9ZN.

8AWX, HIRAM, OHIO.

1AW, 1HAA, 7MA, 1QR, C.W., 1XR, 1XF C.W., 2BB, 2BM, 2FK, 2JU, 2OE, 2OM, 2QB, 2RK, 2SZ, 2TJ, 2UK, 2ZD C.W., 2ZL C.W., 2ZM, (3AD), 3BG, 3BP, 3BQ, 3BZ, 3DH, 3EL, 3EN, 3FK, (3GO), 3HB, (3HG), 3KM, 3NB, 3OU, 3PU, 3XC, 3XF, 3XQ, 3YE, 3YK, 3YV, 4AL, 4CK, 4XC, 4YB, 5YD, 5YE, eights too numerous. 9AAF, 9AAW, 9ABL, 9AHO, 9ALS, (9ANV), 9AON, 9AOX, 9AP, 9ARK, 9AWX, 9CP, 9DBE, (9DV), 9ET, 9FI, (9GN), 9GP, 9HI, 9HM, 9HN, 9HR, 9IP, 9JA, 9JN, 9JT, 9KF, 9KO, 9KP, 9KR, 9KV, 9LA C.W., (9LQ), 9LR, 9MC, 9MH, 9OE (9OX), 9QN, 9QO, 9UF, 9UH, 9UK, (9VC), 9WE, 9WW, 9ZB, 9ZJ, 9ZN, 9ZO, 9ZV.

9AHC, ELLENDALE, N. D.

2RK, 4XC, 5DW, 5HL, 5HV, 5IB, 5IF, 5JD, 5JR, 5JS, 5YH, 5ZA, 5ZC, 6AAM, 6AJX, 6ED, 6GP, 6IG, 6JT, 6TH, 6WV, 6ZH, 6ZX, 6BQ, 7DH, 7EX, 7FI, 7FL, 7HS, 7KX, 7LU, 7LY, 7MO, 7ZG, 7ZM, 8BO, 8CD, 8CF, 8CG, 8DC, 8DP, 8DR, 8DZ, 8FG, 8FT, 8GC, 8IB, 8ID, 8IK, 8IP, 8JJ, 8JM, 8KM, 8KP, 8LQ, 8LU, 8NI, 8NZ, 8OJ 8QJ, 8TT, 8VY, 8XC, 8XK, 8XS, 8YG, 8ZA, 8ZL, 8ZR, 8AAK, 8ACC, 8ADE, 8AGK, 8AIB, 8AIO, 8ALY, 8ANA, 8AOI, 8AYF, 9AAC, 9AAE, 9AAF, 9AAG, 9AAJ, 9AAO, 9AAP, 9AAW, 9ABH, 9ACD, 9ACL, 9ACN, 9AEG, 9AEJ, 9AEN, 9AEQ, 9AEY, 9AFO, 9AFX, 9AGN, 9AHO, 9AHS, 9AHZ, 9AID, 9AIF, 9AIS, 9AIY, 9AIZ, 9AJI, 9AJN, 9AJS, 9AKC, 9AKX, 9ALG, 9ALH, 9ALK, 9ALO, 9ALS, 9AMQ, 9AMS, 9ANF, 9ANP, 9ANV, 9AOH, 9AOJ, 9AON, 9AOU, 9AOX, 9AP, 9APQ, 9ARJ, 9ARX, 9ASF, 9ASK, 9ASL, 9ATO, 9ATV, 9AUO, 9AUU, 9AVS, 9AWG, 9AWK, 9AWX, 9AWZ, 9AXU, 9AYE, 9AYS, 9AYU, 9AYW, 9BM, 9T, 9BW, 8CP, 9CS, 9DAT, 9DBT, 9DBU, 9DCG, 9DCN, 9DCO, 9DDS,(9DE, 9DF, 9DFC, 9DFT, 9DGP, 9DIW, 9DKS, 9DO, 9DV, 9EC, 9EI, 9EL, 9EQ, 9ET, 9EW, 9FF, 9FG, 9FJ, 9FN, 9FQ, 9FX, 9GC, 9GP, 9GY, 9HI, 9HK, 9HM, 9HN, 9HT, 9IF, 9II, 9IY, 9JA, 9JK, 9JL, 9JN, 9JQ, 9KA, 9KF, 9KK, 9KL, 9KO, 9KR, 9KS, 9LC, 9LF, 9LQ, 9LR, 9LW, 9MC, 9ME, 9MH, 9MS, 9NQ, 9NR, 9OE, 9OM, 9OO, 9OX, 9PN, 9PS, 9PV, 9QP, 9QR, 9RG, 9RY, 9SQ, 9TH, 9TI, 9TV 9TW, 9UK, 9UT, 9UU, 9UV, 9UY, 9VB, 9VC, 9VE, 9VR, 9WC, 9WI, 9WW, 9XXAE, 9XI, 9XL, 9XT, 9YA, 9YAC, 9YI, 9YM, 9YW, 9ZB, 9ZC, 9ZJ, 9ZL, 9ZN, 9ZQ, WC1, WL2.

9OE, WICHITA, KANS.

2BK, 2RK, 3FT, (3IW), 3NB, 4AG, 4YA, (4XC), 4XB C.W., 5BM, (5DW), 5EA, 5EJ, 5EK, (5ER), 5ES, (5EW), 5GR, 5HL, (5HV), 5IB, (5IF), (5IS), (5JD), (5LR), 5MX, (5XA), (5XB), 5YE, (5YH), (5ZA), 5ZC, 5ZD, 5ZG, 5ZF, (5ZS), 5ZT, 5ZU, (5ZW), 5ZX, 5ZAA, 5ZAB, (6EN), 6IB, (6IG), (6JT), (6KA), (6WV C.W. & fone), 7BP, 7DH, 7EX, (7LU), (7KX), (7YA), (7ZG), 8AE, 8BO, 8CF, (8DC), (8FT), 8GB, (8GX), 8HA, 8HG, 8ID, (8IK), 8JJ, 8JL, (8KP), 8KM C.W., 8MH, (8ML), 8MM, 8MR, 8NI, 8OJ, 8QJ, 8RI, (8RQ), 8RU, (8TN), 8UY, 8VJ, (8VS C.W.), 8YN, 8ZL spk. & fone), (8ZN), (8ZY), (8AEE), (8ACF), 8AFS, 8AGD, 8AIB, 8AIO, 8AKV, 8AMV, 8ARS, (NSF C.W. & fone), WWV C.W., 9XI C.W., (9XM C.W. & fone), 9's too numerous.

9DIN, MINNEAPOLIS, MINN.

(9ABD), 9ARJ, 9ACV, 9ACK, (9ACD), 9AEQ, 9 AFX, (9AFA), 9AGC, 9AHL, (9AJP), (9AJL), 9AJQ, 9AKU, 9AMH, 9AMC, 9AMI, 9AMU, (9ANP), (9APV), 9APN, (9AQV), (9AQT), (AQN), 9ARL, 9ASC, (9ASL), 9ASN, 9ASQ, 9ATM, (9TV), (9AUL), 9AWL, (9AWS), 9AXU, 9AXW, (9AYO), 9AYG, 9AZN, 9BT, 9BP, 9BR, 9BV, 9BF, 9CZ, 9CT, 9DGM, 9DM, 9DDG, (9DDL), 9DX, 9AL, (9DIH fone), (9DGV), (9DR), 9DQ, (9DFU), (9DHS), 9DG, 9DA, 9DK, (9DOK), 9DP, 9DL, 9EE, 9FB, 9FK, 9FP, 9FC fone, 9GC, 9GD, 9GZ, 9GN, 9HL, (9HM), 9HK, 9HT, 9HC, 9IP, 9IO, 9IQ, 9IZ, 9JL, 9JI, 9JH, 9KL, 9KV, 9KS, 9KK, 9KN, 9LR, 9LM, 9LT, 9MD, 9MS, (9MB), 9MC, 9MI, 9MO, 9MZ, 9NL, 9NA, 9NC, 9NK, 9NR, 9ON, 9OE, 9OI, 9PA, 9PC, 9PB, 9AN, 9ST, (9SV), 9SN, 9SU, 9SL, 9SK, 9TT, 9TS, 9TW, 9TI, 9UU 9WS, (9WM), (9XD C.W. & fone, 9XM C.W. & fone, 9XL, 9XO, 9YI, 9YW, 9YL, 9ZB, 9ZV, 9ZU fone, (9ZT), 9ZW, 9ZR, 9ZG, 9ZY, 8AFD, 8ALV, 8CL, 8CV, 8CF, 8IK, 8LM, 8LN, 8MJ, 8NN, 8OI, 8QJ, 8QR, 8QL, 8RS, 8VL, 8UU, 8ZK, 8ZW fone, 7AM, 7CT, 7FL, 7EX, 7GC, 7KV, 7PV, 7PT, 7TK, 6LT, 6RA, 55AR, 5FT, 5JS, 5OS, 5OL, 5RS, 3AL, 2RK, 2JJ, 2DL, 1AL, 1HAA.

COLO. WIRELESS ASS'N. (Y.M.C.A.), DENVER.

5BH, 5BI, 5EJ, 5EX, 5FL, 5HK, 5IF, 5JG, 5XB, 5XD, 5YH, 5ZA, 5ZC, 5ZM, 5ZU, 5ZZ, 6AK, 6EA 6EJ, 6FS, 6IG, 6JD, 6XZ, 6ZA, 6ZD, 6ZH, 6ZM, 7DM, 7EX, 7IM, 7KX, 7YA, 7ZG, 7ZH, 9BW, 9CU, 9EE, 9EL, 9HT, 9IF, 9JN, 9JQ, 9KQ, 9KV, 9LA, 9LR, 9LW, 9OE, 9PS, 9VF, 9WU, 9YI, 9YM, 9YN, 9YW, 9YY, 9XI, 9XL, 9XM, 9ZL, 9ZN, 9ZV.

9ZX, 9AAC, 9AEG, 9AEQ, 9AEY, 9AJI, 9ARJ, 9DIJ.

9FD, LAFAYETTE, INDIANA.

NSF, 1AW, 2AF, 2AH, 2BK, 2DA, 2DN, 2DR, 2EL, 2FJ, 2GO, 2RK, 2ZL, 3AMP, 3BP, 3BZ, 3DH, 3FJ, 3GO, 3HG, 3HJ, 3HX, 3NC, 3RJ, 3YE, 3ZA, 4TLE, 4AG, 4BA, 4DP, 4EX, 4FD, 4GN, 4XB, 4XC, 4YA, 5BY, 5DA, 5EK, 5ER, 5IB, 5JD, 5LX, 5XA, 5YH, 5ZL, 5ZS, 7HS, 8AAD, 8AAL, 8AAZ, 8ACF, 8AFB, 8AGD, 8AGK, 8AIO, 8AMQ, 8AXC, 8AWX, 8ICO, 8IDF, 8IIZ, 8LIM, 8PTE, 8USZ, 8UYE, 8AA, 8AE, 8AF, 8AG, 8AI, 8AL, 8AR, 8BA, 8BQ, 8CE, 8DJ, 8DP, 8DR, 8FI, 8FM, 8IB, 8ID, 8IK, 8IL, 8IN, 8JE, 8KP, 8KR, 8LC, 8MF, 8MM, 8MY, 8OM, 8RU, 8SV, 8TE, 8TN, 8TT, 8VJ, 8WR, 8WY, 8XA, 8XE, 8XM, 8XR, 8XW, 8ZA, 8ZD, 8ZG, 8ZL, 8ZM, 8ZN, 8ZR, 8ZV, 8ZW, 8ZY, 9AAC, 9AAF, 9AAW, 9AAZ, 9ABL, 9ACB, 9ACE, 9ACB, 9ACU, 9ACL, 9ADN, 9ADX, 9AEC, 9AEG, 9AFO, 9AGR, 9AHI, 9AMH, 9ANV, 9AOH, 9AQE, 9AQG, 9ARK, 9ASL, 9AST, 9AUC, 9AWG, 9AWR, 9AWV, 9AXE, 9AYH, 9AZE, 9AZX, 9CAF, 9DBX, 9DCN, 9DCU, 9DEN, 9DGX, 9DHZ, 9DIW, 9DKT, 9EON, 9FDH, 9KXR, 9MAJ, 9MAO, 9STZ, 9TQZ, 9WAA, 9ZAC, 9AA, 9AP, 9BW, 9CA, 9CP, 9CR, 9DB, 9DC, 9DF, 9DK, 9DV, 9EC, 9FF, 9FH, 9FK, 9FR, 9FN, 9GU, 9HT, 9HM, 9HN, 9HV, 9II, 9JL, 9JM, 9JQ, 9KA, 9KC, 9KF, 9KL, 9KR, 9KX, 9LA, 9LL, 9LO, 9LP, 9MC, 9MF, 9MU, 9MY, 9OE, 9OO, 9OX, 9PE, 9PP, 9QH, 9QJ, 9QO, 9QR, 9RL, 9SP, 9SQ, 9UJ, 9UK, 9UO, 9UQ, 9UW, 9VC, 9WE, 9WO, 9WW, 9XM, 9XT, 9XW, 9YA, 9YB, 9YC, 9YQ, 9YW, 9ZC, 9ZE, 9ZJ, 9ZL, 9ZQ.

9DCO, LAWRENCE, KANSAS.

5BM, 5HK, 5HV, 5IF, 5LA, 5SF, 5YE, 5YS, 5YW, 5ZA, 5ZE, 6LR, 8AP, 8ARK, 8QJ, 8ZR, 8ZV, 9ACN, 9AEG, 9AEQ, 9AJN, (9AHZ), 9AMS, 9AON, (9AQE), (9ARP), 9AWU, 9AWX, 9BM, (9BT), 9BW, 9DN, 9DU, 9DBS, 9DIW, (9EL), 9GN, (9HI), 9HN, 9JN, 9KD, 9KI, 9KY, 9LE, 9LL, 9LQ, 9LR, 9MC, 9NQ, 9OE, 9OO, 9PS, 9QL, (9QO), 9QT, 9RB, (9RY), 9RU, 9SZ, 9TH, 9UT, (9WI), 9YB, 9YI, 9YM, 9YO, 9YW, 9ZA, (9ZH), 9ZL, 9ZN, 9ZQ, 9ZV, 9ZY, 9ZZ.

9KF, CHICAGO.

1XM, (2AR), (2ARK), 2XQ radiophone, 2ZL C.W., (3DH), (3NB), 3XF, (3XM), 3XU, 3YK, 4XB, 4XC C.W., 4YB, 5AL, 5DO, 5HL, 5IB, 5IS, 5JD, 5TW, 5YH, 5ZC, 5ZD, 5ZAB, 8AW, 8AEE, (8ACF), 8AGD, (8AGK 255 cycle), 8AGO, 9ANJ, 8ARS, 8ARW, (8BB), 8BO, (8CD), 8CP, (8DZ), 8EB, 8EL, (8FI), (8FT), 8GI, 9GX, 8HI, 8IB C.W., 8ID, (8IK), (8JL), 8LQ, 8LV, 8MM, 8NZ, 8QE, (8RQ), (8RU), (8TN), 8TT, 8VS C.W., 8WA, 8XK C.W., 8XU, (8YN), (8ZA), (8ZD), 8ZG C.W., (8ZL), 8ZT, 8ZW, (8ZY), 8ZX, 9AP, 9AAC, (9AAP), 9ABZ, 9ACB, 9ACN, 9AHZ, (9AHO), (9AIP), (9AIY), 9AJN, 9AKC, (9AMQ), 9ANV, (9AON), 9AOH, (9AQT), 9ARJ, 9AWW, 9AWX, 9AXE C.W., 9AYE, 9CA, 9DIW, 9EQ, 9FS, (9FQ), (9GP), 9HM, 9HN, (9JN), 9KL, 9KO, (9KY), (9LF), 9LR, 9NQ, (9OE), 9OO, 9OX, 9PS, 9QJ, (9QO), 9QR, (9TII), 9UH, 9UU, 9UW, 9VC, 9WE, 9WU, 9XI C.W., 9XM C.W. and radiophone, 9YB, (9YI), (9YM), (9YAD), (9ZB), (9ZJ), 9ZV.

F. Clifford Estey

(*Concluded from page* 73)

and '12 he operated at the "Evening News" station at Salem as manager and chief operator. This old station, "FBD", always sent the baseball and football dope, and during its day sent out many an interesting story of the world's series baseball games. The old timers remember this station for the speed and accuracy of its operators.

By trade Estey is really a mechanic and not a salesman. After serving a four-year apprenticeship in mechanics he had a year at tool-making and a year at die-making, gradually working up to assistant foreman, foreman, department manager, and finally factory superintendent and production manager of the Dalton Electric Heating Appliance Co. During the war he was with the General Electric Co. at Lynn on the development of special instruments, and instructing draft army classes in wireless at Beverly of evenings. In May, 1920, he was elected president of the Essex County Radio Association and was the originator of the plan inaugurated there whereby the club became truly a County Association with sections in every city in the county and a prodigious total membership. Under his extremely energetic leadership the club has prospered and has become known as one of the most active organizations in New England with "something doing all the time." Mr. Estey has clear-cut and progressive views in club activities, and has been much sought as a speaker on radio club organization. About a year ago his abilities came to the attention of the American Radio & Reasearch Corpn. and he became a member of the Amrad sales force, traveling the length and breadth of the country giving talks on club work, promoting organized amateur activity, and incidentally increasing Amrad sales.

With the removal of the Amrad offices to Medford Hillside, Mr. Estey has become manager of their Sales Division, succeeding Mr. G. Kenneth Thompson, and so is again located in Salem, where plans have been made for the construction of a new amateur DX station that give great promise for the decrease of the difficulties now experienced in getting western traffic into Boston.

Don I. Bailey

(*Continued from page 37*)

of Brandes Superior phones, two Ferron detectors, two buzzers, two keys, 2 ½" spark coils and two pint Leyden jars. He then visited Woolworth's and purchased a rolling pin, then ordered some wire and sliders, and got started on his career as an Amateur Radio Operator. After he got his little rolling pin tuner and ½" coil going he could hear lots of stations but was unable to get in touch with them. Finally his father became interested and together they put in a ¾ k.w. Winger transformer and a flock of Murdock moulded condensers and stepped out for a while, until the Murdocks started popping. So efficient did they become at popping condensers that they claim the championship. After the Murdocks had almost bankrupted them they tore them apart and built an oil condenser using the copper plates, which finally turned the trick.

(*Concluded on page 53*)

The Second District Convention.

THE convention and exhibit held under the auspices of the Executive Radio Council of the Second District at the Hotel Pennsylvania in New York City, March 16, 17, 18 and 19th, was the biggest affair ever held in amateur radio and a very definite contribution to the advancement of Citizen Radio.

On the hotel roof a wonderful exhibit of amateur apparatus was displayed for four days, with most of the prominent manufacturers of America exhibiting their product. Technical talks by prominent radio men were held every afternoon and evening in the adjoining Butterfly Room, and on the last night a most successful banquet was held in the grand ballroom of the hotel with an attendance that eclipsed all amateur records. Special events and stunts added to the interest thruout the four days, and everyone is agreed that a new high-water mark in amateur affairs was set by the meet.

This was the first amateur undertaking in the east in which a serious effort was made to attract the interest of the general public and so increase the prestige of Citizen Wireless. This exhibit was managed in a splendid and professional-like manner from start to finish, publicity was secured in the New York newspapers, and the public responded. The total attendance during the four days was 5165 of which 2765 were paid admissions and the remainder "repeaters" on "season tickets". It is impossible in our limited space to go into any detailed description of the exhibits, but certainly they were a thing to bring joy to the heart of every radio man. Our foremost manufacturers spared neither time nor money to bring the best and newest of their products to the show for all to inspect, and the roof was a maze of aerials which led to the various booths where loud-speakers on receivers vied with the sparks of transmitters in noise making. Among the exhibitors of apparatus were Acme, Adams-Morgan, American Electro Technical, Amrad, Burgess, C.R.L., Clapp-Eastham, Continental, deForest, Doolittle, Federal, Grebe, Mesco, Murdock, Pacent, Lehigh, Radio Corporation, Radisco, Ship Owners', Shotton, Super-Radio, Tuska, Westchester, Westinghouse, and the Army, Navy, and Department of Commerce, and it took the good radio men the full four days to soak in all the dope that could be gathered by circulating thru the hall and studying the displays, asking questions, collecting literature, and getting acquainted.

The series of impromptu talks and lectures on various radio subjects was an interesting feature of the convention. Mr. H. C. Gawler described the new C.W. tubes of the Radio Corporation; Mr. L. M. Clement displayed the Western Electric-Bray movie of the inside action of a vacuum tube in illustration of an excellent lecture on that subject; Mr. R. A. Heising, also of the Western Electric, talked on the constant current system of modulation commonly associated with his name; Mr. G. J. Eltz, of the Mesco stores, discussed antenna and ground resistances; Mr. Edwin H. Armstrong gave a helpful talk on short wave reception at radio frequencies, followed by "Paragon Paul" F. Godley on short wave regeneration. Mr. R. F. Gowen, chief engineer of the deForest Company, described the new equipment of that company; Mr. Frank Conrad displayed the new receiving equipment of the Westinghouse Company and described it and

President Sends Greetings to Second District Meet

President Harding sent the following radiogram to the New York Convention. It was sent out by NAA after time signals on the opening day and was copied direct at the Convention hall. The President said:

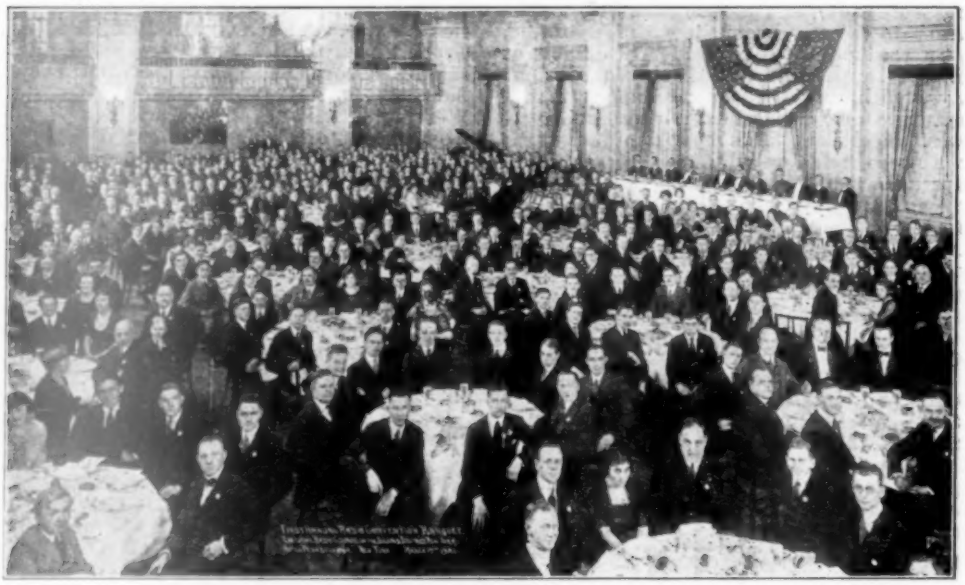
"Citizens Radio Operators Convention,
Pennsylvania Hotel,
New York City.

Greetings and good wishes to an organization whose members have always been leaders of interest in development of the radio science and whose service during the war and since have been of real public benefit.

WARREN G. HARDING."

its development; and Mr. K. B. Warner, Editor of QST, spoke on C.W. Transmission. These talks were scattered over the afternoons of each day. On Friday evening a general convention meeting was held under the chairmanship of Mr. E. A. Beane, Chairman of the Council. Matters of co-operation were discussed at length and the meeting was addressed by Radio Inspector Arthur Batcheller and by Mr. Chas. H. Stewart, Manager of the Atlantic Division of the A.R.R.L.

"Wireless Age" and "Radio News" had booths, and so did the A.R.R.L. At our booth Traffic Manager Schnell kept open house, assisted by Miss Peggy King of our staff, and entertained hundreds of visitors during the four days.



On the evenings of the first three days a contest was held for the world's championship in reception. This was a free-for-all and a large number of entrants started, rapidly dwindling away as the elimination tests proceeded into speeds above 35 words per minute. As the speed grew faster the field narrowed down and the excitement increased apace, with crowds trying to get in to view the few remaining contestants who were then arousing admiration by copying speeds over 40 per. The end was a duel between B. G. Seutter, of the "New York Times" radio station, and N. Bernstein, of Brooklyn, prominent member of the R.T.A. and a Western Union operator by profession, and both had no difficulty in making perfect copy at speeds above 45. Finally Seutter got a wee bit the better of it and hung up a new world's record in copying 48.6 words per minute for two minutes, total 97.2 words, with 2 errors; net result 48.6 words per error, as against the former world's record established by Tony Gerhardt at the Pacific Convention at Frisco last Thanksgiving, who copied 49.25 words per minute for 4 minutes, 197 words total, with 5 errors, netting 39.4 words per error. On this basis Seutter was presented during the banquet with a handsome silver cup, suitably engraved, and is hailed as the new title-holder. (The Providence Tribune had a New York dispatch quoting the new record as 84⅝ w.p.m., which excited the wonder of all the Providence amateurs. For ourselves, we admit that 48⅝ is going some.)

Mr. Bernstein, who came out second in the speed classic, took first prize of a Grebe detector-two step donated by its makers as the winner of a field of twenty-five in the jamming contest, while Albert Bischoff, 2AMF, of Newark, took the main prize in the contest for the best home-made apparatus. The Continental Radio & Elec. Corpn. offered a Paragon RA-10 for the club having the largest attendance at the dinner, and this prize went to the Radio Traffic Association of Brooklyn.

As an interesting side-light, 2ZL, J. O. Smith, Valley Stream, transmitted a thousand-word press story on the convention to 1AE, S. B. Young, Dorchester, for publication in New England Div. Mgr. Guy R. Entwistle's radio column in "The Boston Traveler". Both are C.W. stations. The transmission was accomplished in 1 hr. 20 min., and is rather a record.

The banquet on the last night was a

brilliant affair, ably presided over by Mr. J. O. Smith, who by the way was Chairman of the Council's Convention Committee. Five hundred and ninety-six enthusiastic radio folks gathered in the beautiful ball room of the Pennsylvania and heartily enjoyed a splendid dinner and a series of brief addresses by prominent radio lights, interspersed with a little entertainment. This attendance eclipses all former records for an amateur banquet. The speakers were, besides Mr. Smith, Mr. H. C. Gawler; Mr. F. H. Schnell, our Traffic Manager; Dr. A. N. Goldsmith, Secretary of the I.R.E.; Mr. J. Andrew White, Editor, Wireless Age; Mr. H. P. Maxim, our president; Mr. Arthur Batcheller, local radio inspector; Lieut.-Com. D. C. Patterson, Naval District Communication Superintendent; Mr. Edwin H. Armstrong, who needs no introduction; Lieut. H. S. Paddock of the U. S. Signal Corps; Mr. P. F. Godley of Paragon fame; and Mr. K. B. Warner, Editor, QST. At the conclusion of the evening an immense "hatchet" was brought in and with great ceremony was formally buried in token of the birth of a new feeling of solidarity and union of purpose among Second District amateurs.

Our heartiest congratulations to the Second District amateurs. A most splendid job they did, and their achievement will ever stand as having marked a distinct step forward in the affairs of amateur radio—a job done up in typical New York style and of a nature that only New York could do.

Ohio Radio Convention

One hundred and sixty enthusiastic radio men met in an Ohio Convention in Columbus on March 5th under the auspices of The Columbus Radio Club and A. R.R.L. At 10:30 a.m. there was a get-together meeting in the Southern Hotel with Mr. Lucas president of the local club, presiding. After lunch a technical meeting convened, and some very interesting papers were delivered.

Traffic Manager Schnell spoke on the efficient handling of relay traffic and gave pointers for the guidance of new-comers. He was followed by Mrs. Chas. Candler, 8ZL, who very interestingly told how she handled traffic. Mrs. Candler stated that on "sitting in" she always listened for thirty minutes before opening up, in order to ascertain what stations could be worked consistently that night, thus avoiding QRM from unsuccessful attempts to connect thru fading, etc., and she also pointed out the importance of knowledge of geography as a preventive of poor routing. R. H. G. Mathews of 9ZN spoke on spark transmitters in his customary fashion, and characterized the hot-wire ammeter as the second biggest liar, stating that the first B.L. was the reported circulation of two w.k. magazines. Mr. Candler told of the apparatus at 8ZL, incidentally mentioning that the same condenser has been in use there for six years. (Knock wood, O.M.) R. A. Brown, 8XI, Ohio State U., delivered a valuable talk on the interior action of vacuum tubes, illustrated with many curves. R. S. Copp, of McCook Aviation Field station WA1, spoke on C.W., both AC and DC, explaining the action of various circuits in detail. Ohio is "nuts" on C.W., and paper and pencils were very much in evidence while Mr. Copp spoke.

A splendid banquet was held in the evening, Mr. R. C. Higgy introducing Mr. J. Breeze as Toastmaster, which position the latter gentleman certainly occupied to the satisfaction of all present, many "Hi's" attesting to his wit. The evening speakers were Mrs. Candler, Messrs. Lucas, Mathews, Schnell, Spiller of Cleveland, Breckel of 8XB, Combs, and Copp.

The Second Annual Banquet of The Radio Club of Tacoma.

As reported by Royal Mumford, 7ZJ.

You know I've always thot there weren't many Tacoma fellows in the wireless game. But it's a mistake. Bill and Russ and I counted at least a hundred on a little walk of just a few blocks on our first morning there. You see we arrived on the morning train at 5:25 and first thing we did after getting a bite to eat was to go around and wake up 7CE. I 'spose he had been up late the nite before, but he didn't seem to hold any grouch on that 6:30 visit. Mighty fine fellow Reichert is, and a mighty good station he has. Besides being president of the Tacoma Radio Club, he is an all-around good fellow and a far sighted radio enthusiast.

The members of the Tacoma Radio Club have been working on this banquet for a long time. You would be surprised to know how hard all the mothers, sisters, and sweethearts did work to make it the success it was. It adds all kind of pep to a radio club to have enough of the fair sex in attendance so that everything isn't a stag affair. And you have to hand it to the Tacoma Club, they have some real lady operators.

Walking into the banquet rooms we first noticed a miniature antenna erected in the center of one of the tables. It was made of real wire, and the cute little lead-in went straight thru the roof of one of Miss 7CB's doll houses! And the operator —he was a Kewpie friend of another fair operator and was 'sposed to represent the Young Squirt. And say—the miniature pair of fones he wore! No ordinary radio operator put on that artistic finish—it showed unmistakable feminine handiwork.

In one corner was a huge Magnavox

and we were promised some radio music. There was no hesitation in the promise. And later we found their confidence was not misplaced, for they had an emergency phonograph in the kitchen that worked the Magnavox to capacity. The whole room was exquisitely decorated and believe me we cannot help but admire all this work. I'll bet the women folks put up the biggest part of it. And of course we know they put up the eats, and washed the dishes—but that comes later.

President Reichert met us in the hall and the reception he gave us one and all we never will forget! Everybody had a tag tied on his lapel with his call letters and name. We met and shook with familiar sparks. There is 7BK of Seattle. The quiet student we meet is entirely different from the anticipated possessor of the cleanest and snappiest fist in Seattle. There is CL1 in uniform. We almost expected to see him in rags and tags after those rumored riots over hold-up accusations at Camp Lewis. But no, he is the smartest dressing dressing soldier I ever saw. Then we meet 7BQ of Eugene, and any number of more or less familiar sparks of Seattle and Tacoma. With us three from Portland and Vancouver they had quite a gathering of radio men of the Pacific Northwest.

The foremost topic of conversation was that most annoying feature of our communications between Portland and Tacoma, QSS. From what I learned they hear us about the same as we hear them. Of course they think we're pretty poor actors I guess. But I sure have changed my mind about them. The livest bunch of radio fellows anywhere are right in Tacoma. And I haven't told you about the species OW, YL, OG, or WW, of whom at least a dozen were present. But they were QRW with eats in the kitchen. And when we sat down to the spread of honest-to-goodness home-made food, and were waited upon by the young ladies of the Tacoma Radio Club—say, you stay-at-homes were sure SOL.

Then we were introduced to the members of the Tacoma Radio Club by our toastmaster. To these gentlemen we are indebted to no small part of our entertainment. Then each of us in turn had a chance to say more or less. It was worth the whole fare here and back to hear what these fellows representing the entire Pacific Northwest had to say. Sometimes we held our sides in laughter at the recital of some humorous anocdote. Then our hearts expanded in appreciation of our reception with every expression of thanks for this wonderful banquet. I must mention in particular President Reichert's speech. We understood with his opening words the success of the Tacoma Radio Club. Their organization is founded on the subordination of individual interests for the benefit of the whole. I thot of the minor petty jealousies and predjudices that wreck many an otherwise promising Radio Club. Here they nipped that in the bud. "Co-operation" was the keynote of his speech. We thrilled with pride as he mentioned the possibilities of the co-operation of all the radio clubs of the Northwest, and an annual meeting. Nearly everybody present expressed approval of his idea. No one club would necessarily lose its prestige in the least, while every one of us would be decidedly benefitted by the wonderful results of our co-operation.

And in the midst of our eats, what gentleman is that at this late hour? We were all introduced to Rev. Sebastian Ruth, better known as 7YS. He is first and foremost a radio enthusiast. We welcome his hearty enthusiasm.

Did we all admire the good looking smile of Miss Winifred Dow, 7CB, the first fair operator in the division? I'll say we did. And is that her twin sister who coaxed us all into making away with another piece of cake? Her sister, yes, but not her twin altho we can hardly tell them apart. Both are spilling over with enthusiasm just like an oscillating audion. And then there were others. But we hear, "Surely they can't be radio ops, there ain't any place for the phones!" NO! But, you just otta see a girl copy. Gee but it's great when they write down every letter at 20 per. You've got to give 'em credit for more gray matter than the average.

Next day we travelled all over Tacoma. Saw the city, saw stations and stations without end. First class sets too. I never did see so much high grade receiving apparatus or so many panel transmitters. I tell you these Tacoma birds are right up to date. A fellow here without a loop or cage is actually considered slow in this burg.

And the hospitality of Mr. and Mrs. 7CB and family. They outdid themselves in their efforts to entertain. They dubbed Russ "Slim" for short, but always were forgetting themselves and calling him "Fat". They called Bill "Dimples" because he didn't have any. Say, fellows, you certainly missed the jolliest time you ever had in your life if you didn't get in on this banquet. I actually had no idea that such an honest-to-goodness good time was possible. One and all, we will never forget the solid enjoyment of the Tacoma Club's entertainment. Why, we're already looking forward to their banquet next year. The only way it could be better would be for a few more outsiders to come and allow themselves to be entertained. And that is just what these Tacoma sports are planning on.

EVER suddenly become aware some good radio night that in the last ten minutes all signals have curiously become weaker, and looked over your shoulder to discover that the sun was coming up? If you have you are eligible for admission to the Boiled Owls—fellows who have sat out a "night" until there was nothing left to it.

Many new members were made during the January Transcons we'll wager. We know that 8ZY, 9ZN, 1MO, 1AW, 2TT, 1TS, 8ZL, and 1KBW belong. Who else claims membership in this fraternity of the bloodshot eye and the taste like a blacksmith's apron?

The Old Man started something when he dubbed us Boiled Owls.

Newspaper headline: "Scientists discover that sleep is not necessary for bodily health". Something new? Hell no! Boy, page Mr. Hewitt of 2RK and Mr. Mix of 1TS!

In an editorial on page 29 of March QST, mention was made of the work 1AE was doing on C.W., in company with several other stations, all using a wave length of about 350 meters. We should have mentioned that 1AE is operating on 340 meters under a temporary permit from the Radio Inspector—not simply banging away over 200 on his own hook.

One of the gang suggests that when the Blue Laws come into effect they will seal our receiving sets on KDKA's wave so we can hear nothing but church services.

8ATU defines the height of his ambition as
A reputation like 8ZL's
A wave like NAM's (Hi!)
A tone like 8IU's
Power like NSS
A sense of humor like T.O.M.'s.

The Army Air Service stations XK-1, Mitchell Field, L. I.; XB-1 Bolling Field, Anacostia; and XF-1, Langley Field, Hampton, Va., are equipped with 1 k.w. deForest Oscillion transmitters operating on 375 and 450 m. XK-1, operated by H. J. Perkins (8AEC), requests reports on its sigs, working CW on 375 m. with 4 amps. from 7 to 8 p.m., and CW and phone on 450 m. with over 5 amps. thereafter. They will be glad to QSR relay traffic as far south as XF-1.

A formidable document has been received here wherein eight good amateurs attest that at 6WN, in San Diego, Cal., the signals of 6MZ, in Del Mar, can be read by sense of touch, placing the fingers across the phone terminals. A five-step amplifier was used.

6MZ has entered formal claim for the hand engraved rubber spark gap. Has any eastern bird done better?

Thru error the advertising of American Electro Technical Appliance Co. has mentioned their catalog of 84 pages. It should have read 24 pages.

We are mighty proud of our cover this month. This work is the product of The Grogan Photo System, Inc., in Milwaukee, whose business is illustrating merchandise and stimulating sales by photographic advertising, and is a much appreciated gift to us from Mr. Merwin Grogan, Publicity Manager of The Milwaukee Amateurs' Radio Club (affiliated). The Y.L., by the way, is a well known model in that part of the country.

We again wish to point out to our readers that in writing authors concerning articles in QST it is the smallest common courtesy to enclose a stamped self-addressed envelope for their convenience in replying.

Guy R. Entwistle, New England Division Manager, is conducting an interesting column every week in the "Boston Traveler", an evening paper, under the title "Citizen Wireless—Dots and Dashes". The radio news of the amateur world is reviewed, and information valuable both to amateurs and newcomers in the study of Citizen Wireless is incorporated. We would like to see more of these columns—they do a good work in stimulating interest in Radio.

Re our mention of the arrival of the power tubes. It should be noted that the Audiotron Mfg. Co. is handling these same tubes under the name of Cunningham

tubes. Both they and the Radiotrons are made by the General Electric interests.

Well, well, well. Have you seen "The Rádio Condenser", published in Baltimore? If any Third District amateur is missing it, let him get wise, for here's another of those chummy little magazines full of the local news and the spirit that puts pep into things. (Besides, Miss Garmhausen is on its Staff.) Next to "Radio Topics" the "Condenser" is the most ambitious of the sectional organs that has come to our notice in size, scope and appearance. We offer our admiration and congratulations. It would seem to us that the "Condenser" might well become the mouthpiece of the recently-formed Third District Council, since from its inception it has devoted itself wholeheartedly to Third District affairs and has shown that it stands for the best in amateur operation.

The Delta Division has caught the spirit, too, and blossomed forth with a three-page mimeograph monthly named the "Delta Division News". This is another of the strictly A.R.R.L. publications, gotten up by A.R.R.L. men for A.R.R.L. men. They serve a most useful purpose in a division, giving the Division Manager a means of addressing his own personnel at length on A.R.R.L. matters, and serving to hold the crew fast together with the old inimitable A.R.R.L. spirit.

1OE has an enclosed gap in which the housing is made from the brake-drum of a Chalmers car with a Ford rear wheel hub and flange bolted to it to cut down the size of the hole in the center, the tapered axle hole run full of good babbit and bored to fit the rotor shaft, thus providing a 4½" bearing on which a Benwood rotor is mounted. The cover is a piece of ¼" boiler plate, and the stationery electrodes are mounted in fibre bushings in 1½" holes in opposite sides of the case. This gap cannot be heard outside the station room.

"One or two more conventions in quick succession and we know where we could find several healthy cases of divorce, desertion, separation, etc."—R. T. A. Bulletin (New York).

But of course Thiede has been married only a couplamonths.

Ever find a message coming in for you and discover yourself completely minus paper and pencil? A member suggests that a slate and pencil, tied to the table, will prevent such a predicament.

Canadian 3GE has overcome induction in his receiving set from nearby power lines by simply connecting the filament end of his secondary (loose-coupler or honeycomb) to the ground end of the primary. Well worth trying.

IN 1928 FATHER INSTALLS A RADIOTELESCOPOGRAPH

The Parkin Mfg. Co., of San Rafael, Calif., agree that it is time for the prices of radio apparatus to take a drop, and in their new catalog they have reduced the prices to the tune of about 25% on most of their products. We're glad to see the downward tendency.

Re the list of big DX records published in April QST: the following additional records have since come to our attention:—

2ZM, Paterson, N. J., heard on C.W. by ship off Guatemala on Pacific side, as mentioned in "The Log of an Amateur at Sea" in our March issue. 2ZM's input at the time was 850 watts, wave 325 m.

8ML, Cleveland, heard Feb. 26 at 7ZJ, Vancouver, Wash.

8IK, Ashland, Ohio, heard Feb. 23d by 7JE while operating on U.S.S. Snohomish at Port Angeles, Wash. 8IK was using a 15-watt C.W. set—get that, you spark hounds: fifteen watts.

9ZB, the Benwood station, St. Louis, has been reported from Los Angeles.

2RK and 3DH (now 3XM) also join the ever-increasing bunch of transcontinentals, both now having been reported by a ship operator off the California coast; details lacking.

WOULDN'T IT BE WONDERFUL—

If 2EL would break a leg or else borrow a Kolster so we 4th district felows can hear somebody else besides him? (Signed by six 4th-district amateurs.)

If 8BBD and 8ANE would junk those side-swipers?

If 4YA cut out that derned "Hi! Hi!" every other word while working local Atlanta mugs on high power?

If 6EA and 6GI could work 5ZJ?

If 8AAZ would forget to call the roll some night?

If 1JBT wouldn't use a full kilowatt to work a certain 18-watt spark coil around the corner from his station?

If 5DA was on the job every night?

If 5ZA could get 4YA like the latter gets him?

If the telephone companies just loved us?

If 3GO would tell us where his VT-1's come from?

If 3HJ would take a vacation?

If the ops at NAI, WHE and 3XM wud get their toes manicured before they go on watch so that they wouldn't get 'em mixed up in the set screws on the key?

If 2RK's new 500 cycle set made one quarter the noise that his old synchronous fog-horn made?

If U.S. amateurs would stop reporting American 3BP when it has already been announced that he isn't working and that the 3BP they hear is Canadian 3BP. (Listen for that intermediate "FM".—Ed.)

If 1GM would stop CQ-ing after ten p.m.?

If NAD would get up off 200 meters?

If 4GF could get outside of Savannah on his half k.w.?

Dear Eddy:

Please advise if 73 means you have 73 msgs to send, and if so how do these fellows have so many all the time?

D. B.

You answer him, Vermilya—here's our largest ohm saw.

Cleaning Copper Quenched Gap Plates

Instead of using a piece of emery cloth and tediously polishing the surface of each individual plate of your quenched gap, buy a few thimblesful of concentrated nitric acid. Soak the end of a piece of wood covered with waste in this acid and "wash" the sparking surface with it, dipping it immediately in water to get rid of the acid. It gives a beautiful surface without effort and in far less time. Be careful of the brown nitrogen dioxide fumes which come off. Altho they are not poisonous they could not exactly be recommended as a good substitute for air.

—Contributed by A. W. Parkes.

In Portland, Oregon you do not buy your apparatus on the installment plan. Instead you get your short wave regenerative set on the "piece at a time" plan. It is like this, and the plan seems quite original to us: The purchaser who does not accumulate cash at a rapid rate saves until he has enough for the purchase of the stock variometers which are used in the final construction of this set. He takes them home, and puts them to use with the apparatus that he may already possess. He also begins again to save money until he can purchase a stock vario-coupler of the same make. This he also puts to use along with the variometers. Later he may purchase the series condenser that goes in the set. And finally, when he has the balance of the price of a new set in hand he may pack up his variometers, vario-coupler, and series condenser, and send the bunch in to the manufacturer. In a few days back comes his same pieces of apparatus all nicely mounted in a standard oak cabinet, and on a bakelite panel with all controls, binding posts, etc. And all told he has only paid the price he would have had to pay for a complete set, and has had the advantage of having the use of the parts of the set as fast as he has earned the money to buy them with. And he has a real set in the end.

Northwestern Division News.

P. A. B. says that altho his sister's youngest kid ate all the currents from his A battery, and the bees from his B battery ate the honey from his honeycomb coils, he was able to hear Mars tell Venus last night to go chase herself.

Never listen in before calling CQ. 3PU doesn't, so why should you?

Don I. Bailey

(*Concluded from page 46*)

About a year later they junked the old transmitting set and put in modern apparatus.

Don took four examinations for the Navy, three for the Army and two for the Draft but was S.O.L. Probably if he had claimed exemption he could have gotten across, but as it was he was placed in Class 1A and there remained, ending by instructing code in the Vocational School of the State University of Iowa. Since the war 9CS has joined the Amrad users, and the receiving set has been completely changed, it now being a C.R.L. Paragon and a Tresco Universal 150 m. to 20,000 m. cabinet, with a radiophone and a ½ k.w. arc set under construction.

Radio Communications by the Amateurs

The Publishers of QST assume no responsibility for statements made herein by correspondents.

"HEARD AT SEA."

(Note: Mr. Guthrie's letter has brought forth a storm of protest, from which we publish a few letters.

The A.R.R.L. has always discountenanced work between amateurs and ships at sea in the knowledge that it is absolutely contrary to the law. A.R.R.L. relay men have been active in reporting and stopping such activity in many instances. Nor would we ask any operator to do a single thing that detracted from the rigid observance of his duties. We certainly agree with our readers, however, that an operator's time off-duty is his own, and believe that Mr. Guthrie will agree with us that it is better to have the operator in the static room listening on 200 than to have him get out as quickly as his watch is over.)

QST, then, will continue the publication of calls heard at sea when it seems probable that the operators turning in the lists have not neglected their duties to give us a helping hand.—Editor.

Madison, N. J.,

Editor, QST:—

In regard to the letter of Mr. L. R. Rutter and Mr. F. P. Guthrie in the March issue of QST on page 52, I would like to state some plain facts as seen by the commercial operator himself. I, being a commercial operator, am able to lay bare these facts.

I shall first touch on their 3rd paragraph which is the most important.

We shall let out the 2-man ship as this type of ship usually is large and a continuous watch is required. The one-man ship is the key to this whole situation.

In the old type of watch the operator was required to listen in the first 15 minutes of every hour, from 8:00 a.m. to 8:00 p.m. and many operators still use this type of watch. The new type of Shipping Board watch, known as the zone system, which came out about last September, required Shipping Board operators to listen in 2 hours straight and then he is off 2 hours, then on again for 2 hours, etc. The time of this watch is governed by the longitude in which the ship is.

It will be seen that in the first type of watch the operator has the last three quarters of an hour to himself, he being off watch. In the second type of watch the operator is off watch 2 hours at a time.

Does anyone mean to say a commercial operator has no time to listen in on 200 meters?

As for an SOS, the operator would not hear it anyway if the SOS occurred between watches and the operator was off watch.

As a ship has the privilege of broadening its wave when sending an SOS, if the operator was listening in on 200 meters at the time, it seems highly probable to me that it could be heard. Many ships can be heard on 200 meters when they are working on 600 meters *and they are not supposed to be heard on 200 meters.* I'll admit that there are quite a few well tuned ship stations, but they are few and far between.

I thoroly agree with the fourth paragraph of said letter. Amateur stations should not work commercial stations. It is not only against the rules but it causes unnecessary QRM.

The fifth and last paragraph of Mr. Rutter and Mr. Guthrie's letter is absolutely out of the question. Their suggestion may be all right for the ham squeak-box stations of yesterday but not for our modern amateur 1 K.W's., C.W. and radiofone stations of today. This is proven by our recent attempts to bridge the great pond. We are continuously reaching out and as our ranges gradually increase, the old U.S. will have become too small to test the ranges of our stations.

Take for instance, if we had a thoroly modern amateur station in California which was heard very QSA on the Atlantic Coast, his range would naturally be greater than the breadth of the U.S. (especially when using C.W.) and the only practical way to find his correct or maximum range would be for a Europe-bound ship to listen in for him until his signals grew weak and unreliable. Adding the total number of miles from coast to coast to that of the number of miles the ship is off shore would give the maximum range of said station.

Further comment is invited.

Sincerely,

A. G. Dick, "XN".

26 Kent St., Gloversville, N. Y.

Editor, QST:

I notice on page 52 of March QST the letter by Mr. Guthrie in regard to the amateur calls heard at sea by commercial operators on U.S.S.B. vessels.

On page 9 of December issue of the Radio Service Bulletin, year of 1920, there is an article in regard to the hours that operators on U.S.S.B. ships stand watch, on ships that carry only one operator. Of the schedules for the five different zones, eight hours is the maximum number of hours that the operator has to stand watch in any twenty-four. This leaves the operator sixteen hours off duty. It does not seem that it would harm the receiving set any aboard the ship to listen to the 200 meter amateur stations for an hour or two daily; besides, the operator gets some very good practice.

As long as the operators put in their required eight hours of specified time each day on commercial traffic there is none of the U.S.S.B. time wasted, even if the operators listen to 200 meter amateurs off duty. It is possible that the operator might miss an SOS call if he at that moment were listening to 200 meter stations, but I don't believe that many operators are going to listen on 600 meters off watch in hopes that a stray SOS might come that way. It seems to me that such a schedule would make a more of a miss in receiving SOS calls because it leaves all the one-man ship operators off duty at one time, leaving all the responsibility of receiving SOS calls on the vessels that carry two or more operators and keep a continuous watch. Such ships are quite often a goodly distance from each other.

Regardless of how much the operator listens in on the two hundred meter wave when he is off duty the operator's log shows how much time he put in and also what kind of duty. It would be impossible for the operator to fake the call letters of ships he heard and get away with it as in checking up the calls he surely could be caught. No one can listen in on 200 and 600 meter wave lengths at the same time and keep any kind of a log.

It is a mighty hard life on many of the U.S.S.B. ships, taking all into consideration, and I am sure no human being would want to deprive any one of a little recreation off duty. I have been a commercial operator for some time and as yet have a commercial first grade license. I was in the amateur game from 1913 until a few years ago when I took up the commercial part of it, but I am back to the amateur end of it for good now, for going to sea on U.S.S.B. ships is no life; it's life lost.

All for rightfullness,
Louis E. Krieg, Jr.

609 W. 30 Street,
Indianapolis, Ind.

Editor, QST:

In regard to the article in the March QST pertaining to the publishing of calls heard at sea, I am positive that the writer overlooked quite a few things. I just returned home after eight months of commercial work in the gulf and have sent in a list of calls heard on two different occasions. I agree that it is contrary to rules and regulations to work with amateurs from ship stations. Both lists that were turned in, first from the S.S. Coppename and then the S.S. Ellis, were calls that were heard while IN PORT. As there are no watches kept while in port this was done for pastime and is absolutely within the law.

It is true that most of the ships reporting calls give their position somewhere at sea but in all cases I have noticed that they were one operator ships which DO NOT REQUIRE CONTINUOUS WATCH. I was never on a one-operator ship myself but I have a great many friends who were and none of them were supposed to remain on watch after Arlington had finished broadcasting his WX, PX, and TRFC, providing all traffic was cleared and there was nothing special to stand by for. After this time why shouldn't an operator tune down to two hundred meters if he is interested in the amateur work? If he didn't do this he would probably turn in or engage in some other pastime, so I think that it is a very good idea to publish the calls heard at sea as it gives the amateurs a better idea of how they are getting out as well as putting a little spirit into the monotony of commercial operating.

Very truly yours,
M. B. Lowe.

OUR RAISON D'ETRE.

6227 Kimbark Ave.,
Chicago, Ill.

Editor, QST:

In your article in the February QST on Transatlantic Sending Tests, you make the statement that the English radio experimenter is more of an "engineer" than an "amateur". It seems to me that this distinction between the engineer and the amateur should be given more attention than it is at present, especially in the case of the American amateur. Of course it is possible for a radio man to be both an amateur and an engineer, but I believe you will find most of us to be predominantly of the one type or the other. It is a state of mind: the engineer making his own apparatus for the joy of being able to create it, and using it for the sake of the results he gets out of it; and the amateur either buying his apparatus completely assembled, and as nearly as possible ready to

use, or operating the set of one of his neighbors, who is an engineer.

Amateur radio has a threefold argument for existing: first, that it is a right for citizens to be able to communicate freely with each other; second, that the amateurs provide trained operators essential for military uses in defense of the country in case of war; and third, that real improvements in the art and science of radio must result from the unrestricted experimenting of the amateurs. Granting the first point, I believe it will be seen that, excepting accidental discoveries, the "amateur" type provides the second, and the "engineer" type the third argument. And altho I may be in error, it is my personal conviction that the third reason for the permission of amateur radio is by far the most important. No one can foretell for what necessity Americans will have to defend their country, and moreover operators can, if necessary, be trained (in code, at least) inside of a month; but the advances of radio are real and permanent contributions to America and to mankind.

It follows that the really important use of the A.R.R.L. relay messages is to provide material for the engineer to use in weeding out the defects and unnecessary parts of the equipment they are using, and to establish the value of the improvements they adopt. And this sort of testing is worth more than all the "amateur" gossiping in the world. Coast to coast relays such as the recent record-breaking ones would have been impossible with the crystal detectors and untuned and inefficient transmitting sets we used before the war. The introduction of vacuum tubes and regenerative circuits is due to the work of American amateur radio *engineers.*

I am afraid that my use of the words "amateur" and "engineer" has been unfortunate, since the word "amateur", as usually used, includes both classes of radio men. Perhaps "ham" would have been better. But a real distinction exists, and I hope QST will encourage the growth of an increasing number of amateur radio engineers.

Sincerely yours,
Kenneth H. Goode, 9BJ.

TO GET EVEN FOR WHICH WE'LL JUST PUBLISH AN EXTRA PAGE OF 'EM!

1022 So. Ash Street,
Casper, Wyoming.

Dear Eddy:

I am so blamed hot under the collar that if I had on a celluloid neck piece it would be smoking now. Take the darn —— —— and turn to page 654 in "Correspondence from our Readers" and see what Honorable Mr. S....sky (a Bolshevik I bet two bits by his name) says about calls heard. Man, he is hitting at our beloved QST and, by golly, Eddy, are you going to let him get away with it? He hasn't the guts to mention QST and anything a relay man hates is a bird who beats around the bust. I'll bet my whole set he hasn't a transmitter and can't receive over two words a minute and then comes out with the stuff he has about "Don't publish Calls Heard". It has made me so blamed sore that I can't punch this old mill as you will see by the erasures on this page. Eddy if we only could put in print what is on our mind it would have to be in a world where there are no fair sex radio hams, but as it is I guess we will have to holler to one that is with us and let it stop at that. But just wanted you to know that such rot gets our nanny and if you start a rumpus with such birds and get into trouble we are all on your tail with a check book to see you thru. Nuff for now, OM.

Very truly yours,
Norman R. Hood, 7KX.

11 Lake Terrace,
Newton Center, Mass.

Editor, QST:

In view of the remarkable publication of yours, and its fine work in the development of amateur radio exclusively, allow me to respectfully submit the following:

I recently noticed an article in a well-known radio publication which seemed, for ome unknown cause, to be extremely prejudicial against the section known as "Calls Heard" which, the writer said, is "but useless 'truck' that some publications use to fill up space, which might be used for valuable articles."

With all due respect may I inquire what this person considers to be valuable? True, the discussions and articles on the various instruments and their theory and operation are valuable, very valuable, but also they are numerous.

A magazine that deals with amateur radio must be expected to put its best foot forward to aid the advancement of what it stands for. May I ask of any real live "ham" that owns anything from a Ford coil to a Poulsen arc, what section of QST he first hastily turns to, with an eager and hopeful heart that perhaps his little home-made rotary has set somebody's far-distant diaphragms to wiggling; or the old boy who has a vague idea that his friend the commercial "op", who promised to listen for him in Argentina, would publish a list of 200 meter calls?

A great man once wrote, "United we stand, divided we fall!" This might be modified to say, "The firmer the bonds that bind us, the steadier may we stand." Certainly that applies to amateur radio. We really may hardly consider ourselves on a very solid foundation, and unless we

work together, and keep in touch with each other as much as possible, with a lot of friendly competition to keep the goal always ahead; and lastly, to keep all that savors of commercialism out of the game, we are apt to find ourselves each at the edge of an individual pit of darkness, which is the worth that could befall.

Yours very sincerely,
R. D. Ayer.

A GOOD IDEA.

197 Dearing St.,
Athens, Georgia.

Editor, QST:

What do you think of the idea of amateurs registering their calls with the Postmasters of their respective towns or cities? I believe every amateur prizes his radio correspondence almost as highly as he does his set, and lack of names and addresses prevents delivery of many cards and letters. Many time I have worked a station, perhaps under difficulties, and, asking for QRA got "QRA Pittsburgh, Pa." Now how in the name of Sam Hill can I WRITE A FELLOW on such dope as that!

By the simple expedient of registering their calls with their Postmasters every operator would be assured of receiving all mail addressed simply to HIS STATION, with city and state address of course. For instance:—*Radio Station 4AG, Athens, Ga.* on a postcard or envelope would be immediately delivered to OM W. B. Pope, 197 Dearing St., Athens, GA.

If this idea appeals to you get busy and give it publicity in "QST" and let's stop the return of so many card and letters "For better address".

With best wishes, I am,
Yours very truly,
W. B. Pope, 4AG.

CO-OPERATION.

Hammond, Ind.
Feb. 17th, 1921.

Editor, QST:

This can be classed as "another country hear from" for it is my first attempt to gain recognition as a contemporary of O. Henry or any of the rest of the humorists and satirists. However, being constituted about the same as the general run of "radio bugs", there are a few thots in my mind which are just naturally HOWLING for utterance.

I'll open my little story with an incident which we have all experienced more or less—and to those to whom the "less" applies let me say they can consider themselves favored by the gods. How many of us have seated ourselves at our operating table on a good cold, crisp night, thinking to hear a little DX, and then find the "young squirt" who lives about five blocks away evidently trying to see how long his arm will hold out and making a pretty fair endurance record at that? Do I hear remarks from several?—you bet I do!! Well, I don't know about the rest of you but on the first occasion that I had this delightful experience I bethot myself of the telephone as a medium of arbitration. Consequently, I hied myself hence, but soon learned what a simpleton I was to dream of arranging matters in that manner. There was no chance to reason with "friend squirt" and arbitration was not in his vocabulary—or make-up either. Wasn't the air free? Wasn't he a licensed opr? Wasn't this the DX period? Didn't I have the same right to call that he did?, etc., etc. Well, I admit that so far as rules and regulations go he was right. I thot at first of doing likewise and call every DX guy I heard. But on second thot I saw the hopelessness of that for his imagination had mine licked to a standstill for besides polluting the air with calls he really did hear, he IMAGINED he heard more calls than there are listed in the "blue book". So what was I to do? I thot of everything from "sitting on my key" to the construction of a QRN-maker to tie on his antenna. Nothing seemed adequate to the occasion, however, and I may as well admit I never have figured out a way to "come back" at the "young squirt." Do I hear some say "capital punishment"? Yes, that might solve the problem but have you ever noticed that nearly every case of QRM of this nature comes from those at that stage of existence called the "tender age of youth"? Such is the age of my "disturber of the peace" but even so he is fully as obnoxious as the most ancient Limburger cheese. So much for the "young squirt."

Now fellows, to get down to seriousness: Those of us who have been in the game since the very start cannot help but see how indispensable is co-operation. We know that without it Amateur Radio would have perished long ago. Even had it existed up until the war, there is no doubt of what would have happened to us when certain illustrious members of our government tried to keep us forever silenced as we had been for nearly three years, had it not been for said co-operation. Yes, we know, but how can we go about instilling that feeling into the numerous "young squirts" who are the bug-bears of today? Can DX relay work ever amount to anything if QRM continues to be so rampant as it is now? Why, I have repeatedly heard stations clearing (or rather trying to clear) traffic only to be held up by interference from some inconsiderate "HAM" in their near vicinity who could not help but know they were working DX. And

what is the usual text of the HAM's transmission that he deems it more important than MSG's.? Nine times out of ten it is SA OM QSA? QSB? QTC? etc. And there you have one very good example of lack of co-operation.

There is just one more example I want to give before I quit and that is the interference two nearby stations will cause for each other if both try to clear traffic at the same time. I have heard it hundreds of times. It is human nature of course for each one of us to think our MSG's. of more importance than the other fellow's and because of that, about the only way such form of QRM can be minimized is in the method of calling a station to whom a MSG is going. If the rules as set forth in the law would only be followed, we would soon see a change for the better in our traffic conditions. Call the station three times and follow by your own call three times. If you don't raise him the first tme wait three minutes before calling again. If on the second you fail again, try a third time after a three minute period has elapsed. Then if you fail to get him you can feel reasonably sure he is either not on the job or out of your range. Why the three minute period between calls, you ask? To give anyone else in your vicinity who has MSG's. to clear a chance to call *his* station. And now, fellows, should he raise his station,stand by for him until he finishes. It may take longer to clear traffic in a city where there are several long distance men, but you will find that in the end it will make for better relay work and a much better feeling between amateurs—in other words, co-operation.

I have raved enough and so will call a halt. But I want to say just this, that I'm with the majority and what rules are made for the betterment of Amateur Radio will be given my support always.

One of the mob,
9AF.

1NAQ, Hartford, Conn.

Editor, QST:

Not to any small extent during the past few weeks have I heard the phrase "Sorri OM QRM spark coil hr" from several stations in several districts, and it seems very strange that only a few cities can boast of having a clear working period for all concerned. What's the trouble with certain DX men who hope by mere strength of power in watts output to overcome the spark coil? It can't be done that way at all. You fellows who may read this can paste one word in your memory: CO-OPERATION. And DX men have to live up to it as well as the squeak boxes. Don't try to brow-beat the coil, because he will jam back every time and your DX msg. is going to strangle of hook-wormus at the other fellow's station if you don't give that coil a chance. You may think I own a coil. No! Nor do I own a Ford either. But to lay things open for the DX traffic to move smoothly you must give in to those coils because the DX is in the minority. Now under those conditions what are you going to do? Easy—make a schedule giving the small sets the biggest part of the 24 hours, yourselves with power sets a smaller part, and *live up to it yourselves.* The biggest half of the trouble causing QRM is from the DX men who are HAMS, who jump on a set as soon as they can cram a potato and gullup a mug of coffee at supper time, and who hammer the key from then until they have to quit for utter exhaustion. Their usual run is confined to "73 CUL QRK OM QSA QSS" and, of course, "QRM". Now, you fellows in the 8th district especially, who are living in some of the best cities in the world, you who do a disappearing act on said potato and coffee and who at 10:30 or 11 p.m. are crying out "QRM hr OM sorri CUL"—lay off your keys until 10 p.m. and give that young lad a chance. He has got to learn the game, same as you had to, and he is in the majority, so you must pipe down for your own good and for the good of all DX. Get the gang together, all of them, and tell 'em: "Here, you spark coils go to it 6 a.m. to 11:45 noon, 12:15 noon to 9:45, and then "SK". We of the DX class will go to it 10:10 p.m. to 6 a.m." And if you put it up to them right and live up to it yourselves, they'll do the same and your old excuse of QRM will be passe. It's just co-operation all the time that makes DX easy.

You may say "Oh bunk! it can't be done", but somewhere in your city is a man who can organize this schedule and get the co-operation of all concerned, and that man may be you. You don't know until you've tried—and it certainly beats threatening, cutting antennas, etc.

Let's have less of this useless QRM stuff and quicker moving of traffic thru these cities where coils are numerous—*it can be done.*

Yours truly,
J. C. Randall,
Dist. Supt., Northern Conn.

A SIMPLE CIRCUIT.

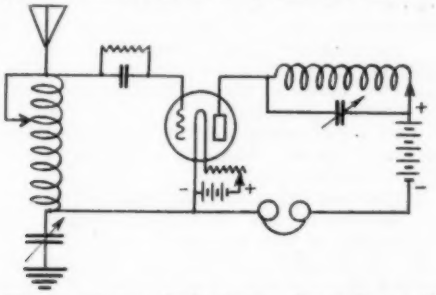
2048 Fifth St.,
Port Arthur, Tex.

Editor, QST:

After reading the article "Some Experimental Regenerative Tuners" in March QST I thot I'd suggest a design myself. It has the advantage of only two controls, one for regenerative and one for tuning; it gives excellent amplification, comparing favorably with the variometer sets on the

market now; and lastly, it gives good selectivity.

I show the circuit here; note that the plate circuit is tuned. The antenna series variable may be .0005 to .0015; .0005 is all that is necessary as you cannot use a .001 condenser past about 50 on a 180-degree scale and still have good selectivity —past 40 the tuning broadens rapidly. With an .0005 good selectivity can be obtained on readings up to 100 or 120. In the plate circuit use anywhere from .0003 to .0015. I use .001 with good results.



Your antenna inductance depends on the aerial you have, of course, and due to the fact that such a small series condenser is used it will be necessary to tap it about every five turns beginning with the 10th turn. The plate inductance can be tapped less frequently. Eighty turns, tapped every 20 turns, is sufficient for waves from 150 to about 800 meters. The two coils can be wound on same form if desired, if several inches are left between adjacent edges (I use 1½"), and about 3½ inch form is OK. The switches should be arranged to short-circuit the unused turns.

Yours very truly,
L. W. Hatry, 5KN

CORRECTION.

8TY, Jamestown, N. Y.

Editor, QST:

In March QST you say you believe that was the first time QST had a calls list reporting stations from every district. ND, OM: see QST for April, 1917, page 56, 9ZN's list. Also QST for January, 1921, page 50, 9RR's list. Both have stations from every district, and there may be others for all I know.

R. W. Bissell.

FOR THE COMMERCIAL OPS.

Editor, QST. Brooklyn, N. Y.
My dear K. B.—

A few lines in hope to do some good among 600 meter men. You 200 meter chaps who think you have a hard time with QRM, etc., just try standing eight hours on 600 in or near New York. I'm firmly of the belief that half the commercial operators are half-witted. The rest are idiots. Anybody doing this for a living is, as has often been noted, necessarily nuts, or becomes so in short order.

Everytime you call traffic list, either two birds will test on full power in your front yard (no sines,) or three chumps will call you for QTC? (you didn't call them, but that's no matter.) If anyone you did call comes back, he gets swamped. Or you start a fellow about 821 miles south with important message. You just get started when S.S. Yapalaga opens up to say G.N. closing down. If he wasn't open to hear you start another ship, how can he close down, I ask? Or two ships about five hundred miles out, making so much QRM between themselves that they think they are QSN the coast, will chew the rag an hour patching up NAA between them, and exchanging copies of their TRs and messages on file, so the first one who hears the beach will clear both. "'See you in the morning, after breakfast and tell you how I made out." And so on, ad infinitum, ad nauseam.

Were I the boss of a one-man committee having absolute charge of radio I would institute the following:

Install recording devices in key circuit of all transmitters, to eliminate testting, etc., anonymously. Also to see who knows the code and who doesn't.

Isolate the type that sends words twice, or slow, or repeats the whole message unless you ask him to, so the breed would die out.

Take phonograh records of some bird's erratic sending and make them copy it back. (Ever been in court, and had your testimony read back to you? Know how foolish it all sounds? You get the idea then.)

Award one blown fuse (not "economy".) monthly to the guy that uses the most juice and turns in a blank abstract.

Award one defunct Marconi tube to the bird that calls you repeatedly with his detector out, and then yaps for CQ QSR?

Award three brown derbys to the three best operators on the coast. They would go every time to "HQ" (Munson Line,) "WE" (United Fruiter) and

Yours truly
"WE"—WC G.

A REACTANCE-COUPLED AMPLIFIER

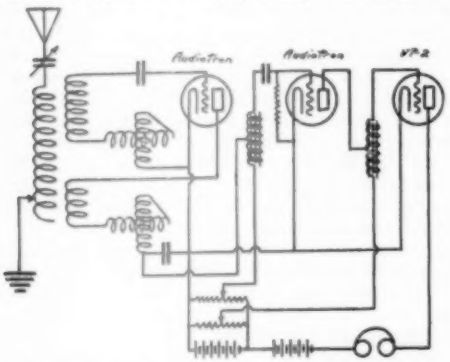
342 Union Ave.,
Laconia, N. H.

Editor, QST:—

I am enclosing a diagram of the hook-up I am using for amplifying, and as I have never seen it published or known of its being used it may be worth publish-

ing as it works better than anything I have tried yet. A one-step like this will give as loud signals as an ordinary two-step.

About the only difference from the usual is the use of an auto--transformer for coupling the tubes. This makes possible the obtaining of out-put and input impedances correct for the tubes used. The amplification is obtained from the turns-ratio, the small amount of wire used, and the lowest copper loss. In my case I am using a single B battery for all three tubes but a separate battery may be used for



each if desired. Also I am operating the 1st step on the lower bend of the tube curve with low A and B batteries, and the 2nd tube on the straight portion of the curve in the regular way. This does not seem to distort radiophone speech quite as much as the regular transformers.

I can see no objections to auto-transformers but there may be some I have not found and I would like you opinion.

Hope you may find use for this little bit of dope.

Yours truly,
H. R. McLane, 1CM.

LETTER FROM FRANCE.

Nice, Nov. 9th, 1920.

My dear American Friends,

I have been asked again to write a "Letter from France" for "QST" and I gladly comply with that demand hoping that the information I can give you about the state of affairs concerning the radio Amateur in France will interest you.

In my previous article written on the 22nd of January last I was expressing the hope that a new and more liberal regulation of amateur activities would soon be put in force. At that time we all thought that reception at least was about to be officially permitted and that perhaps even transmission would be allowed to a certain extent. Personally I had founded great hopes on the optimistic views a high rank army officer had expressed to me some time before.

Well, the regulation came in February and was a great deception to all radio enthusiasts!

According to that regulation the erection of receiving stations alone can be allowed and these stations must be intended exclusively for the reception of time signals and meteorological information. To obtain this permission a demand must be addressed to the Director of Posts and Telegraphs of the region in which the station will be installed and if this locality is less than 50 kilometers distant from a frontier or from the sea-shore, a special permission must be obtained from the Military or Naval authorities. In the demand of authorisation a complete description of the station must be given and no change can afterwards be made in the apparatus used without special permission to do so. Besides all this, much unpleasant official formalities have to be gone through. The annual tax is five francs.

Some well informed law specialists think this decree of the Ministry of Posts and Telegraphs is not lawful.

But if the above regulation is very strict, fortunately it is not at all strictly enforced, as you will see by the following which is a translation of a paragraph which appeared in "L'ONDE HERTZIENNE", a French radio magazine.

"According to the answer made by the Under-Secretary of State for Posts and Telegraphs to Monsieur Berthon, a Deputy, (Journal Official of April 3rd, 1920) the above decree has been taken in order to establish a very simple regulation for the granting of licenses for the erection of time signals receiving stations. As there is no possibile means of ascertaining that a station is meant only for the reception of time signals, the Administration must necessarily accept the declaration of the applicant and only compel him to make no use whatever of messages which he might overhear by radio."

As you can imagine from the above, reception is still going strong in France. The QRN have been very bad during the summer but diminished considerably and abruptly a few days ago and listening in is once more a real pleasure. When I tune down to 600 meters I seldom wait long before the high pitched spark of some American ship comes in, usually very QSA, and I often think of a time, previous to the war, where, except for the warships who had came to Villefranche in 1913, I had never heard a single American ship work by radio. Times have fortunately changed and it is a great comfort to see that the bonds of friendship which have developed during the war are everlasting and to hear the talk of the mysterious aether waves say that young America has not forgotten the road to the shores of her old friend France.

(Signed) H. T. S.

AN AMATEUR'S IDEA OF PARADISE
WE'RE SURE HAM HEAVEN MUST BE SOMETHING LIKE THIS —DAH
AMATEUR ? LET'S SEE YOUR LICENSE, OM
?
NOTICE! BRING YOUR OWN PHONES
OH BOY!
ALL RADIO APPARATUS FREE! COME IN
ELECTRICAL
THE INITIATION CONDUCTED BY ST. PETER
THIS MUST BE HEAVEN!
THE "OLD MAN" FROM THE EARTH - SPEAKER OF THE CONVENTION
A FAIR DELEGATE FROM VENUS
PROF. MARZITI, P.M., F.O.B., OF THE HARYALE UNIVERSITY MARS
THE YEARLY UNIVERSE AMATEUR RADIO CONVENTION
AW GIVE US SOMETHIN' NEW!
HELLO HAWAII HOW AR-RE YOU
WUXTRY !! ALL ABOUT TH' NEW RADIOVISUAL-PHONE
QST
QST
STRAY STRAINER
CW
AUTOMATIC RECORDERS AND CALLING DEVICES
WOUFF HONG
INVENTIONS IN USE HERE
THE WIRELESS HARP (NO STRINGS ON IT)
QST OUT EVERY DAY

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of QST published monthly at Hartford, Conn. for April 1, 1921.

County of Hartford } ss.
State of Connecticut }

Before me a Notary Public in and for the State and county aforesaid personally appeared K. B. Warner, who, having been duly sworn according to law, deposes and says that he is the business manager of QST and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The American Radio Relay League, Inc., Hartford, Conn.; Editor, Kenneth B. Warner, Hartford, Conn.; Managing Editor, (none); Business Manager, Kenneth B. Warner, Hartford, Conn.

2. That the owners are: (Give names and addresses of the individual owners, or, if a corporation, give its names and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock). The American Radio Relay League, Inc., an association without capital stock, incorporated under the laws of the State of Connecticut.

3. That the known bondholders, mortagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: (If they are none, so state). Hiram Percy Maxim, Hartford, Conn.; John S. Dunham, Brooklyn, N. Y.; C. D. Tuska, Hartford, Conn.; W. S. Browne, Brookyn, N. Y.; C R. Runyon, Jr., Yonkers, N. Y.; Nicholas Roper, Youngstown, Ohio; Chas G. Godfrey, Bridgeport, Conn.; Frank Conrad, Pittsburgh, Pa.; F. M. Bookwalter, Springfield, Ohio; Chas. A. Service, Jr., Bala, Pa.; Miller Reese Hutchinson, New York City; George M. Woodcock, Buffalo, N. Y.; C. Tefft Hewitt, Swissvale, Pa.; Leonard D. Fisk, West Hartford, Conn.; H. E. Rawson, Chicago, Ills.; Emma Candler, St. Marys, Ohio; Chapman Printing Co., Hartford, Conn.; Robert F. Gowen, New York City; E. C. Wilcox, Meriden, Conn.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear on the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is..... (This information is required from daily publications only).

K. B. Warner

Sworn to and subscribed before me this 14th day of March 1921.

Wm. Lacey Wells, Notary Public
(My commission expires February 1, 1925.)

5EJ, AUSTIN, TEX.

(*Concluded from page 40*)

two-step, and Baldwin phones.

5EJ, has been reported from Canton, Ohio, Sioux Falls, S. D., and as far south as Guatemala. Relay traffic is regularly handled at the rate of about 50 messages per month.

THE SIGN of a GOOD RADIO MAN!

Where's your A.R.R.L. Emblem? Got yours yet? If you haven't you should place your order at once. By this sign a radio man is known wherever he goes. It is surprising how many amateurs you will meet up with if you wear the little "sine"—and a jolly good feeling it is, too, to become acquainted with a familiar spark just because you both wear the A.R.R.L. button. Get your sign and let a feller know you "belong."

Extra heavy rolled gold and black enamel, ¾" high. Screw button or pin mounting—specify which you want. Postpaid for $1.50—Immediate shipment.

A.R.R.L. 1045 Main St., Hartford, Ct.,

Are You Looking for a REAL GOOD Textbook on Radio?

—A book that will be authentic, one you can rely upon, one that will go into detail and tell you what you want to know and yet not clutter it up hopelessly with ungodly mathematics? Here's it:

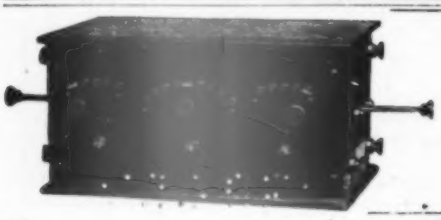
"Radio Engineering Principles"

By Lauer & Brown

300 pp., 6x9. Price, $3.50 postpaid.

Ask any amateur who has read it and he will tell you it is the book you need. We recommend it.

Q S T, 1045 Main St., Hartford, Ct.



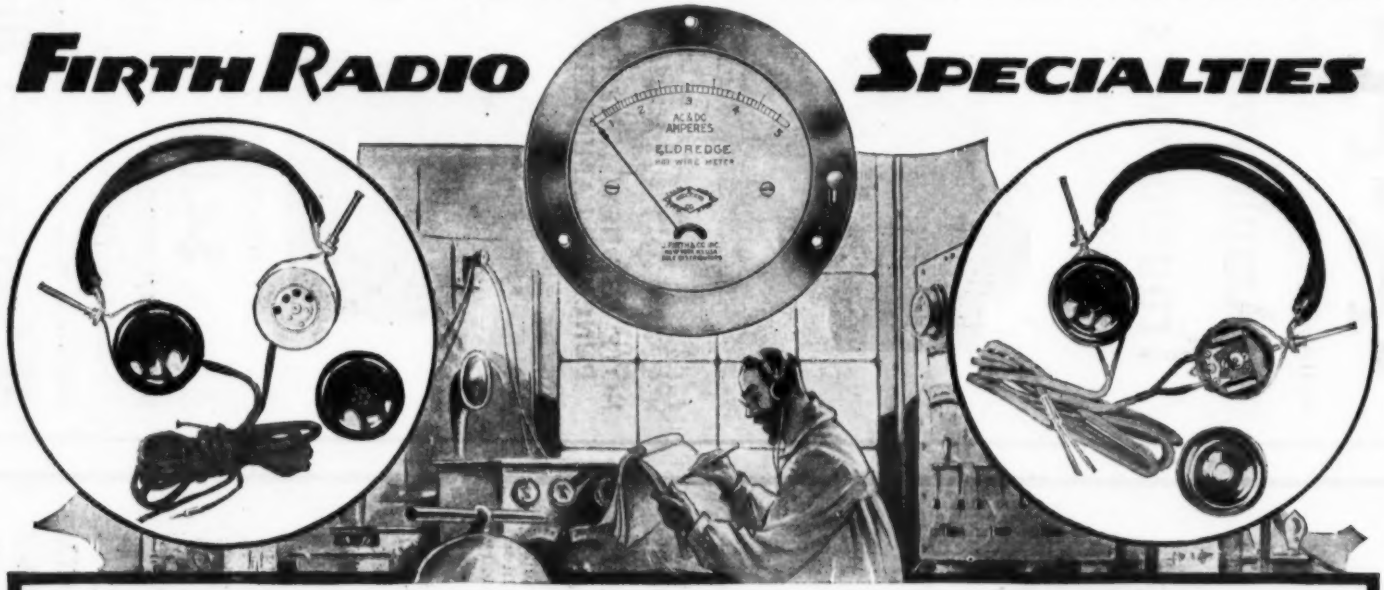
GETTING PHONE CONCERTS?

This Regenerative Tuner gets them O. K. as well as all other 200 to 600 meter stations. Mr. F. H. Calhoun, Charlottesville, Va., says: "Regenerative Tuner working fine." Send a 2 cent stamp for bulletins.

Colby's Telegraph School, Auburn, N. Y.

Your dealer's salesman will be glad to explain to you the delicate, sensitive construction of these

FIRTH RADIO SPECIALTIES



BALDWIN PHONES

Set new amateur world's records!

Famous mica diaphragm, super sensitive 'phones,—used by H. D. Selvage in the first trans-continental amateur spark reception,—used in the trans-continental relay on Jan. 18,—used by the U. S. Navy, the British and French governments, commercial operators all over the world, and by thousands of leading amateurs.

Original Type "C" **$16.50**
Improved Type "E" **20.00**
Type "F" **21.00**

ELDREDGE METERS

Each one has hand-calibrated, individually-engraved scale dimensions. Distinguished by their high polish nickel finish, unvarying accuracy over 25 years of service, and the reasonable prices.

Radio Frequency Ammeters and Milli-ammeters $7.00
(Model Shown)
Advance "Midget" Ammeters and Voltmeters, 12 ranges AC and DC, $8.00
Model S-D specially designed for 60 cycle transformer primary circuits Voltmeters, $10.00; Ammeters, $9.50.

BROWNLIE PHONES

Can be instantly adjusted for changes in signal strength and pitch. Adjustable feature makes them the most sensitive and selective of all metal diaphragm telephones.

Single solenoid core is directly under the exact center of the diaphragm. Eight sensitive springs for support, allow the diaphragm to vibrate thruout its entire area.

One model, 2,000 ohms, light weight, rugged, equipped with Improved Baldwin type headband. Price $12.50.

Ask your dealer for booklets describing any of the above Firth Specialties.
If he lacks a supply, write, mentioning his name and address, direct to

JOHN FIRTH & COMPANY, Inc., 18 Broadway, New York

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Licensed under Marsh patent No. 811859.

Shramco Reo

with "NICROME" resistance

Unusually accurate and delicate variation of the filament current is an outstanding feature of this panel type rheostat. Perfectly insulated thruout. "Nicrome" resistance element is mounted on asbestos block. All metal parts brass. Spring phosphor bronze blade. Unconditional guarantee of satisfaction accompanies every Shramco Reo.

Price $2.00 each. Resistance 6 ohms. Base 3". Overall height 2½". Include postage for 1 lb.

for power tubes.

A new type Shramco Reo, with "Nicrome" resistance of 1.5 ohms, for use with 5 ampere power tubes will be ready May 15. Remember, thousands will read this ad, and the supply of these new rheostats will, at first, be limited. Send for information now.

SHOTTON RADIO MANUFACTURING CO.

P. O. BOX 3, SCRANTON, PA.

Special resistances made to order.

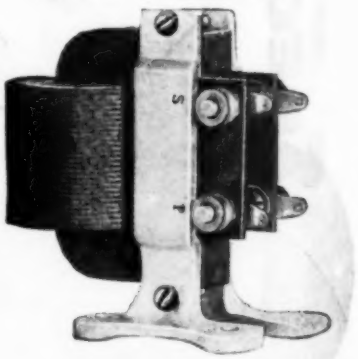
Send 5c. for catalogue "K".

-A-A-

AUDIO FREQUENCY

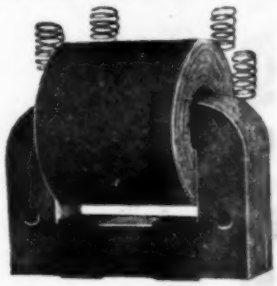
Amplifying Transformers

HIGHEST QUALITY
MOST EFFICIENT



$5.00

NOTE THE NEW (ONE PIECE) PUNCHED LAMINATIONS



UNMOUNTED

$4.00

SEMI-MOUNTED $4.50

—DEALERS WANTED—

Shipments Made From Stock Prepaid.

All American Elecl. Mfrs.
815 S. WISCONSIN AVE.
OAK PARK, ILL.

Didn't You Know?

WE Supposed everybody knew that any apparatus ordered from Corwin Mail Order Service was *guaranteed*,—to be shipped at once,— to arrive in perfect condition,—and to give *complete satisfaction.*

If you didn't know that, now go ahead and order from Corwin with perfect confidence.

Universal-Coil Mounting Plugs.

Anyone can easily make smooth-running mountings with these plugs. No bending, no filing, they are made to fit exactly, in the first place. Suitable for Radisco and all hand wound coils. A few minutes work with these plugs will save you dollars that can be put into better apparatus! *Price 80 cents, postpoid*

VARIABLE CONDENSERS
A.R.CO. .001 ..... $6.25
A.R.CO. .0005 ..... 5.00
With No. 67 Dial add 1.00
Murdock 366 ..... 4.75
Murdock 367 ..... 4.75
Murdock 368 ..... 3.75
Clapp-Eastham 800 ..... 7.50
Clapp-Eastham 800A 9.50
Clapp-Eastham 800B 11.50
Complete with dial
Shipping Weight One Pound.

GRID CONDENSERS
Radisco, postage 3c 35c

ANTENNA SWITCHES
Murdock, 3 pounds $4.50
Clapp-Eastham, 10 pounds 12.50

OSCILLATION TRANSFORMERS
Murdock No. 424 ..... $5.00
5 lbs.

RADIO CRAFT PRODUCTS
Detector $15.00
Two step Amplifier 50.00
Detector and one step 45.00
Detector and two step 70.00
Postage paid.

"B" BATTERIES
Radisco No. 1 (2 lbs.) $1.50
Radisco No. 5 (5 lbs.) 2.65
Eveready Storage Battery
prices on application.

TUSKA C.W. APPARATUS
181 Coil (2 lbs.) $7.50
182 Coil (2 lbs.) 10.00
183 Coil (3 lbs.) 12.50
170 Filt. (8 lbs.) 16.00

AERIAL WIRE
7x22 tinned copper
100 feet 2 lbs. $1.25
200 feet 4 lbs. 2.40
500 feet 8 lbs. 6.00

AMPLIFYING TRANSFORMERS
A.R.Co. (1 lb.) $5.00
Federal (1 lb.) 7.50

JACKS AND PLUGS
Federal Closed Circuit $0.85
Federal Open Circuit ..... .70
Federal Double Circuit 1.00
Federal Plug 2.00
Postpaid

ALL RADISCO COILS and
Wireless Press Books.

NEW RADISCO VARIO-COUPLER.
Moulded Base, Formica Tube, Brass for all metal parts. "Accurate to a fraction of a hair's breadth: (PRICE $7.50 Postpaid).

VACUUM TUBES
Electron Relays $6.00
VT Amplifier (1 lb.) 7.00
VT Extra hard for transmitting 7.50

ROTARY SWITCHES
Clapp-Eastham No. 19 ..... $1.00
Clapp-Eastham No. 19A ..... .35
Our Own No. 1 ..... .40
Our Own No. 2 ..... .55
Postage ..... .05

CORWIN DIALS
No. 66, 3" $0.75
No. 67, 3" with knob 1.30
No. 68, 3⅞" 1.00
No. 69, 3⅞" with knob 1.70
Postpaid

RECEIVERS
Murdock No. 55, 2000 ohm $4.50
Murdock No. 55, 3000 ohm 5.50
Brandes Superior 7.00
Baldwin C 16.50
Baldwin E, improved 20.00
Brownlie new 12.00
Shipping weight, 2 pounds.

CONTACT POINTS
CP No. 1, Brass, dozen 25c
P No. 4, Brass, dozen 35c
CP No. 5, Nickel Plated 45c
Postpaid.

VARIOMETERS
Radisco No. 1 ..... $7.00
Radisco No. 1D 8.50
3 pounds.

LOOSE COUPLERS
Clapp-Eastham Radion $14.00
Murdock 344 ..... 9.00
6 pounds.

GROUND OUTFIT
Consists of SPDT 500 Amp. Switch, 25 feet No. 4 wire, clamp and cleats, prepaid $7.00

VT. SOCKETS
Murdock $1.00
Radio Service, Double 2.50
Radio Service, Triple 3.50
Shipping Weight, 1 pound.

All orders for apparatus not listed as postpaid must be accompanied by postage charges.

A. H. CORWIN & COMPANY

Dept. D.4., 4 West Park Street, Newark, New Jersey

INTRODUCING

THE DUBILIER UNIVERSAL CONDENSER

Type 577

Price $2.00

SUITABLE FOR TRANSMISSION AND RECEPTION

THE DUBILIER UNIVERSAL CONDENSER is the first condenser especially designed for low power continuous wave transmitters which will also prove suitable for reception work. This condenser is made of the finest clear India Mica. Its capacity is absolutely constant and is so maintained by special spring clamps which slide on the pressure plates. This unique construction permits an extremely compact unit and the losses are so small as to be immeasurable. They are tested at 1500 volts and rated at 1000 volts and they will carry one ampere of C.W. energy at the rated voltage.

NO. 577 DUBILIER UNIVERSAL CONDENSER can be supplied in practically all capacities at $2.00 each. (See Bulletin D-2 for capacities which are standard.)

BULLETIN D 2 Describing the DUBILIER UNIVERSAL CONDENSER, together with literature describing other high grade apparatus will be sent you on receipt of five cents in stamps.

Dealers—Write immediately for our liberal discounts.

SOLE DISTRIBUTORS FOR
Wicony's Complete line of "Eventual" Apparatus

Duo-Lateral Coils
Standard VT Batteries

Pacent Plugs
Dubilier Condensers
Special Distributors for Brandes Phones.

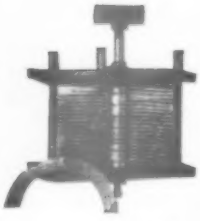
Sullivan Apparatus
Rawson Instruments

PACENT ELECTRIC COMPANY, Inc.

Louis Gerard Pacent, President.

150 Nassau Street, Beekman 5810. New York City

THE WORLD'S CONDENSER MARKET



Knocked-Down Condensers

Assemble them and save money.

11 Plate	$1.80
21 Plate	2.25
41 Plate	3.20 Add P. P.

If you want us to assemble them for you add $1.00, plus P. P., to above prices. Shipping weight 2 lbs.

Glass Plate Condensers—Universal Condensers.

SEND 10c FOR CATALOG OF 16 PAGES TO

TRESCO - - - Davenport, Iowa

LONG LIFE—CLEAR RECEIVING
are the features of

BURGESS "B" BATTERIES

All sizes from the Navy type down to the Baby "B." With and without taps

Send for catalogue

BURGESS BATTERY COMPANY

Harris Trust Bldg. :: :: CHICAGO

Co-operative Radio Purchasing

Co-operate with thousands of other amateurs. Buy your equipment from a single source and get immediate delivery on all your radio needs. Besides securing service you will participate in a division of the association's profits. Send us a trial order for any of the following items, or other wants, and see for yourself how this plan operates; or send stamp for details.

Storage Batteries

Paul M. Marko & Co. of Brooklyn, N. Y. having reduced their prices 10% to us we are reducing list prices accordingly.

Prices:

4 v. 20-40 amp. hour	$9.70
4 v. 40-60 amp. hour	13.10
4 v. 60-80 amp. hour	16.90
6 v. 20-40 amp. hour	14.60
6 v. 40-60 amp. hour	17.10
6 v. 60-80 amp. hour	21.60
6 v. 80-100 amp. hour	32.60
6 v. 100-120 amp. hour	36.00
8 v. 20-40 amp. hour	18.70
8 v. 60-80 amp. hour	32.60
8 v. 80-100 amp. hour	39.40
8 v. 120-140 amp. hour	48.40

AMPLIFIERS (Without Tubes)

Grebe single stage	$25.00
Grebe single stage with control	47.00
Grebe two stage	50.00
Grebe two stage and control	70.00
Clapp-Eastham one stage panel	18.00
Acme Y-2 single stage	13.00

AMPLIFIER PARTS

Moorhead VT Amplifier tube	$7.00
Murdock VT Receptacle	1.00
Acme new mounting transformer	5.00
Federal open circuit jack	.70

AERIAL SWITCHES

Clapp-Eastham Improved type	$12.50
Murdock new type	4.50

AMPLIFYING TRANSFORMERS.

U. V. 712 List Price.... $7.00
Mfg. by Radio Corp. of America

AUDION CONTROLS (Without Tubes)

DeForest P-100 cabinet	$67.50
DeForest P-400 cabinet.	13.25
DeForest P-401 without cabinet	10.90
Grebe tube unit complete	12.50
Clapp-Eastham control panel	12.00
Paragon control panel..	6.00
Acme detector unit....	10.00

AUDION CONTROL PARTS

Moorhead electron relay.	$6.00
Radiotron detector tube.	5.00
Radio service socket...	1.10
G. A. Condenser and Leak	.50
Paragon panel mounting rheostat	1.75
Federal single circuit jack	.70

B. BATTERIES

Standard No. 7623 22½ volt small	$1.50
Standard No. 7625 22½ volt large	2.65
Standard No. 7650 22½ volt variable	3.50
Cyclone 22½ volt small	1.25
Cyclone 22½ volt large..	2.40
Eveready 22½ volt small	2.25
Eveready 22½ volt large	3.50
Eveready box of 10 flashlight cells, 45 volt...	3.50

VARIABLE CONDENSERS

Chelsea .0011 m.f. encased	$5.00
Chelsea .0006 m.f. encased	4.50
Chelsea .0011 m.f. interior	4.50
Chelsea .0006 m.f. interior	4.00
Murdock No. 366 43 plate	4.75
Murdock No. 366 interior	4.25
Murdock No. 368 23 plate	3.75
Murdock No. 368 interior	3.25
Murdock .001 panel type	4.00
Murdock .0005 panel type	3.25

TELEPHONE RECEIVERS

Murdock 55 2000 ohm set	$4.50
Murdock 55 3000 ohm set	5.50
Brandes "Superior"	8.00
Brandes "Transatlantic"	12.00
Brandes "Navy type"	14.00
Baldwin Type "C"	16.50
Baldwin Type "E"	20.00
Western Electric 2200 ohms	15.00

Parts for Complete Rec. Set

Murdock loose coupler	$9.00
Murdock No. 368 Condenser	3.75
Murdock crystal detector	.70
Murdock phone condenser	.70
Murdock 2000 ohm receivers	4.50
Complete equipment	$18.65

UTILITY RECEIVER PARTS

Unit coil holder	$1.90
600 meter coil	1.70
Murdock .001 condenser..	4.75
DeForest crystal detector	2.60
G. A. phone condenser..	.35
Murdock 2000 ohm phones	4.50
	$15.80

AUDION RECEIVER PARTS

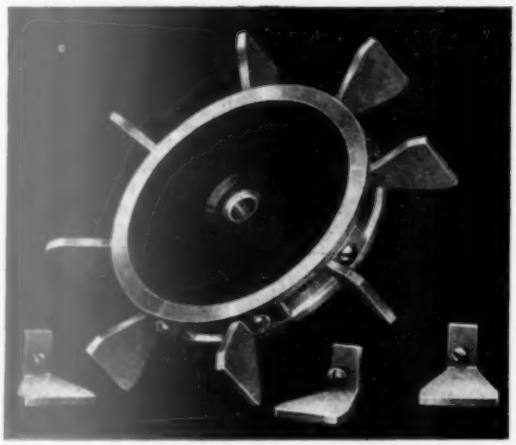
Bakelite panel	$1.50
Coil holder	1.00
2000 meter coil	1.80
Chelsea Condenser	4.50
Binding posts	.50
Acme detector unit	10.00
Brandes Superior phones	8.00
	$27.30

PARTS FOR REGENERATIVE RECEIVER

Bakelite panel	$2.50
2 variometers	10.50
2 large dials	3.40
1 small dial	1.30
1 Vario coupler	7.50
Binding posts	1.00
	$26.20

MUTUAL PURCHASERS ASSOCIATION

Dept. Q, 2 Stone Street, New York City



BENWOOD REMOVABLE POINT DISC

Increase Your Range

WITH THE

Benwood Removable Point Rotor

ANY NOTE
ANY FRENQUENCY

Teeth are RENEWABLE as well as REMOVABLE

Sparking points are variable in number from 2 to 16 and can be furnished in soft copper, aluminum or brass. A CLEAR note can be had at all times; as soon as the sparking points show signs of wear they can be replaced with a complete new set. Just the disc for use with synchronous motors, as four or eight points are available at will.

Disc is SIX INCHES in diameter and ONE INCH wide.
Center of disc is MOULDED BAKELITE, grade XX, and is highly polished.

Price complete with set of 16 sparking points,

$10.00

Specify size of motor shaft when ordering.

We have on hand a limited quantity of 3400 RPM quick-starting motors, induction type, manufactured by The Emerson Electric Co., 1-8th H.P. Ideal for driving any of the enclosed gaps on the market, also for driving small generators for C.W. work. These motors are fully guaranteed by the manufacturer and are of the finest construction possible. While they last,

$25.00 each

We carry in stock at all times a complete and comprehensive line of all radio apparatus and material, and solicit your orders on the fact that we ship all orders the day received.

WATCH FOR THE NEW BENWOOD ROTARY QUENCHED SPARK GAP NEXT MONTH

The Benwood Company, Inc.

13th and Olive Streets, St. Louis, Mo.

Announcement - - - - $25.00 Cash

will be given each month until further notice by THE BENWOOD COMPANY to the amateur who "WORKS" the greatest distance during that month while using a BENWOOD GAP.

NO PREVIOUS RECORDS made prior to this offer will be considered, as we all know that such stations as the following have made some marvelous records and they all use the BENWOOD GAP:

9LR, 8ZL, 5ZL, 5YH, 9KO, 9LC, 9LA, 9ZB, 5ZAC, 9ZCB, 9EQ, 4XC, 3BZ, 9PN, 9ZC, 1NAQ, 9ET, 9JA, 9AUO, 8KE, 1AK, 9EE, 8BA, 9CA, 9AKC, 9QJ, 5YE, 9FG, 9AK, 9UV, 9AEQ, 8DI, 5HK, 9AEG, 8DO, 8MM, 8KM, 8PN, 5BI, 8GX, 9AHS, 8AEE, 9AK, 9ARP, 9JN, 9AKH, 9OX, 8CV, 9CP, 3EN, 9IR, 9SZ (Apologies to the many not included).

There are no catches, "ifs", or "ands" to this offer, but the following conditions must be adhered to so that all will have a fair show and equal chance of winning the monthly award:

1. Absolute proof must be furnished by the station owner making the claim that the distance has been actually "WORKED" by him (or her).

2. By "worked" we mean that actual communication was positively carried on between two given stations, and this fact will have to be attested to by an affidavit signed by a Notary Public. Two affidavits shall be furnished, one by the station owner making the claim and the other by the party he "worked" with. Both affidavits shall contain the following information: The actual distance covered (airline), time, the date, local weather conditions, power used, and antenna dimensions. If both station owners are using BENWOOD GAPS at the time the record is made, both owners shall be awarded $25.00 cash in full. A letter must accompany the affidavits, giving complete dimensions of aerial and ground system used, and must also contain accurate data as to where and when the Benwood Gap was purchased, spark frequency used, and other general information that may be of interest; this letter for publication. Any station winning the award automatically becomes ineligible for further competition in these tests.

There are some 750 BENWOODS in operation so it looks as if this proposition will cost us SOME money, but go to it, fellows; let's see what we can do during the summer months with the "old spark set".

WATCH FOR THE NEW "VISIBLE-SPARK BENWOOD GAP"

With the new Removable and Renewable Point Disc—Two sizes, ... $25.00 and $30.00

Special Notice to Benwood Gap Users

Due to certain limitations in the insulating qualities in the materal used for the side electrode bushings in the Benwood Gaps, there has been some complaint from users to the effect that these bushings are broken down electrically when used with the higher powers. This trouble has even been experienced to a slight degree by users of the "SUPER-BENWOOD GAP". Therefore we wish to announce that, in keeping with our general policy of fair dealing with our customers, any and all of these gaps that are returned to us, transportation prepaid, will be equipped with our new GLASS INSULATING BELL free of charge. This new insulator ends once and for all the insulating troubles that have been experienced with various types of the enclosed gaps now on the market.

THE BENWOOD CO., INC. *13th and Olive St., St Louis, Mo.*

CUNNINGHAM

POWER TUBES

Type C-302

5 watt output

Price $8.00

Demand Cunningham Tubes

The Name is etched on the Tube

CW TELEGRAPHY AND TELEPHONY WITH CUNNINGHAM TRANSMITTER TUBES OFFERS THE ADVANTAGE OF

COMPACTNESS, RELIABILITY, LONG RANGE, LOW POWER, SHARP TUNING

TRANSMITTER TUBE SPECIFICATIONS

Model	Output Conservative Rating	Filament Amps.	Filament Volts	Plate Voltage	Price	Delivery Date
C 302	5 watts	2.35	7.5	350-400	$8.00	immediate
C 303	50 watts	6.5	10.	1000	30.00	Mar. 10th
C 304	250 watts	15.	12.	4000 Max.	110.00	Mar. 10th

Price of C 303—C 304 fob. New York or San Francisco

C 302 is mounted on the standard four prong receiving tube base. The larger tubes have special bases.

CUNNINGHAM POWER TUBES

are the latest product of the great Research Laboratory of the General Electric Co. The trade mark GE is the guarantee of their quality. Each tube is built to most rigid specifications. The output ratings are extremely conservative and in actual test deliver greatly in excess of their rated outputs.

GENERAL ELECTRIC QUALITY PLUS CUNNINGHAM SERVICE

Address All Communications to

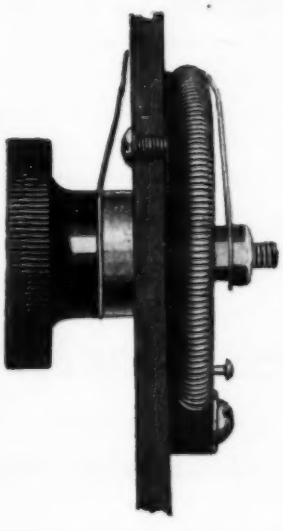
E. J. Cunningham

TRADING AS

AUDIOTRON MFG. COMPANY

35 MONTGOMERY STREET

SAN FRANCISCO, CALIF.



Remler No. 810

PANEL TYPE

Jr. Rheostat

PRICE $1.00

TEN thousand Remler rheostats now in service testify to the value and merit of No. 810. The resistance unit is renewable (an exclusive feature) and is mounted on a bakelite disc. End stop and off position are provided. The knob is of polished bakelite 1⅜" diameter and all metal parts in front of panel are polished nickel. The contact arm is nickel plated spring brass. This rheostat is as smooth running as a coupler switch and only two holes need be drilled to mount it. Resistance 4 ohms, carrying capacity 1½ amps. Designed especially for vacuum tube filament control.

No. 81 Remler panel type rheostat of similar design and appearance is a larger unit of 3 amp. carrying capacity. For controlling the filaments of a group of amplifier tubes or the filament of a 5 watt power tube. PRICE.....$1.75

FREE: Remler catalog is now ready. Send for your copy.

DEALERS: Remler Apparatus offers a merchandising opportunity. Send for full particulars.

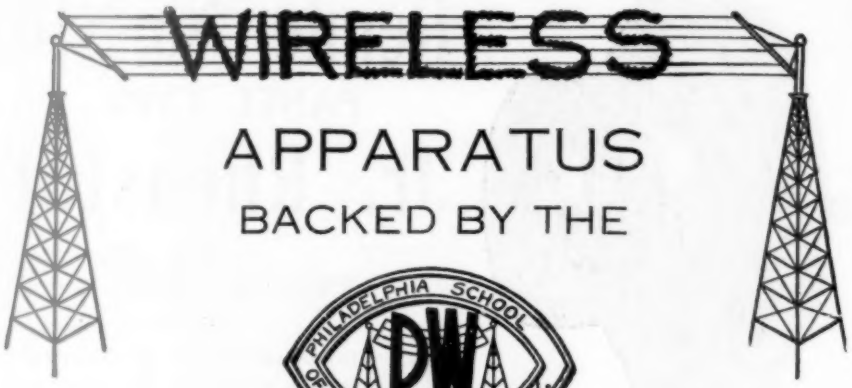
Apparatus that Radiates Quality

Mfd. By

Remler Radio Mfg. Co.

E. T. CUNNINGHAM, Sales Mgr.

163 Sutter St., San Francisco, Calif.



APPARATUS

BACKED BY THE

PHILADELPHIA SCHOOL OF WIRELESS TELEGRAPHY. PW

Reg. U. S. Trade Mark

In addition to the manufacturer's guarantee every piece of apparatus bearing our trade mark has passed our own laboratory inspection, and must operate satisfactorily under **normal** amateur conditions.

Big Business Needs Radio

Special attention is invited to the fact that while no order is too small to merit our most careful consideration neither is any order too large for us to fill promptly and efficiently.

PW has recently furnished the apparatus for one of the largest amateur stations in the Eastern U. S. for an important business house and are now working on two other installations for business houses which appreciate the advantages of Radio over ordinary means of communication.

Men in Our Sales force are all Technicians and are in a position to give the best possible advice on your radio problems.

Philadelphia School of Wireless Telegraphy

Parkway Bldg.

Broad St., Near Arch, Philadelphia, Penna.

MAIL ORDER "SERVICE"

PHILADELPHIA SCHOOL OF WIRELESS TELEGRAPHY PW

Reg. U.S. Trade Mark.

WE SHIP SAME DAY ORDER IS RECEIVED

Our large stock of all reliable makes of Radio apparatus enables us to make immediate Shipment of your orders.

ANTENNA SWITCHES
Murdock, 3 pounds $4.50
Clapp-Eastham, 10 pounds 12.50

AERIAL WIRE
7x22 tinned copper
100 feet 2 lbs $1.25
200 feet 4 lbs 2.40
500 feet 8 lbs 6.00

AMPLIFYING TRANSFORMERS
A.R. Co. (1 lb.) $5.00
Federal (1lb) 7.50

"B" BATTERIES
Radisco No. 1 (2 lbs.) $1.50
Radisco No. 5 (5 lbs.) 2.65
Eveready Storage Battery prices on application

CONDENSERS TRANSMITTING. (Dubilier)
No. D-100 250 W. 10,000 V. .007 MF $19.00
No. D-101 500 W. 14,000 V. .007 MF 30.00
No. D-102 1000 W. 21,000 V. .007 MF ... 45.00

CONDENSERS (Low voltage)
No. ES-355 1MF 500 Volts $1.25
No. ES-356 2 MF 500 Volts 1.25
No. 21AA Western Elec. 1000 Volts A.C. 2.50

CONTACT POINTS
CP No. 1, Brass, dozen 25c
CP No. 4, Brass, dozen 35c
CP No. 5, Nickel Plated 45c
Postpaid

CORWIN DIALS
No. 66, 3" $0.75
No. 67, 3" with knob 1.30
No. 68, 3⅞" 1.00
No. 69, 3⅞" with knob 1.70
Postpaid

GRID CONDENSERS
Radisco, Postage 3c 35c

GROUND OUTFIT
Consists of SPDT 500 AMP Switch, 25 feet No. 4 wire, clamp and cleats prepaid $7.00

JACKS AND PLUGS
Federal Closed Circuit $0.85
Federal Open Circuit ..... .70
Federal Double Circuit 1.00
Federal Plug 2.00
Postpaid

LOOSE COUPLERS
Clapp-Eastham Radion $14.00
Murdock 344 ..... 9.00
6 pounds.

OSCILLATION TRANSFORMERS
Radisco No. 5 ..... $15.00
Via. Express collect only

ROTARY SWITCHES
Clapp-Eastham No. 19 ..... $1.00
Clapp-Eastham No. 19A ..... .35
Our Own No 1 ..... .40
Our Own No. 2 ..... .55
Postage ..... .05

REGENERATIVE RECEIVERS
No. CR-1 Grebe 175-680 Meters $90.00
No. CR-2 Grebe 175-680 Meters 51.00
No. CR-3Grebe "Relay Special" 175-680 Meters 65.00
No. CR-3A Grebe With tube control, 175-375 Meters 45.50
No. CR-5 Grebe's "Super-Special" 175-3,000 meters, tube control, self-contained. Complete receiving set. Just out 80.00

RECEIVERS
Murdock No. 55, 2000 ohm $4.50
Murdock No. 55, 3000 ohm 5.50
Brandes Superior 7.00
Baldwin C 16.50
Baldwin E., improved 20.00
Brownlie new 12.00
Shipping weight, 2 pounds

RADIO CRAFTS PRODUCTS
Detector $15.00
Two step Amplifier 50.00
Detector and one step 45.00
Detector and two step 70.00
Postage Paid

Regen. Receiver, 150-600 M $60.00
Regen. Receiver, long wave type 145.00

TUSKA C.W. APPARATUS
181 Coil (2 lbs) $7.50
182 Coil (2 lbs) 10.00
183 Coil (3 lbs) 12.50
170 Filt. (8 lbs) 16.00

VACUUM TUBES
No. UV-200 Radiotron, detector $5.00
NO. UV-201 Radiotron, amplifier 6.50
UV 202 Radiotron, 5W. power 8.00
UV 203 Radiotron, 50W. power 30.00
UV 204 Radiotron 250W. power 110.00

VARIABLE CONDENSERS
A.R.CO. .001 ..... $6.25
A.R.CO. .0005 ..... 5.00
With No. 67 Dial add 1.00
Murdock 366 ..... 4.75
Murdock 367 ..... 4.75
Murdock 368 ..... 3.75
Clapp-Eastham 800 ..... 7.50
Clapp-Eastham 800A 9.50
Clapp-Eastham 800B 11.50
Complete with dial
Shipping Weight One Pound

VARIOMETERS
Radisco No. 1 ..... $7.50
Radisco No. 1D 8.75
3 pounds

VARIO-COUPLER
Radisco No. 2 ..... $8.50
Radisco No. 2D 9.50
3 pounds

Philadelphia School of Wireless Telegraphy

10th Floor, Parkway Building, Broad Street, Near Arch, Philadelphia

Are you satisfied ?

—that the results you are getting from your receiving apparatus are the best possible?

If not,

you can get better results by using Kennedy apparatus. We have a number of units designed to suit a variety of needs. Kennedy "QUALITY FIRST" Equipment heads the list for DESIGN, WORKMANSHIP and PERFORMANCE

Remember

—that we have a mail order department for those who can't get Kennedy Equipment from their dealers. We carry a full line of radio parts and accessories, bulbs and supplies of other makes as well as our own. Our service is prompt and our prices are right. Ask for our catalogue and price list of parts. They are free.

THE COLIN B. KENNEDY CO.

INCORPORATED

RIALTO BUILDING SAN FRANCISCO

MARVELOUS!-"MIDGET"

The 20th Century Invention of a Wizard-Genius.

Are you a skeptic? You need not be. We are selling apparatus every day. This is not a one-horse company, but a $50,000.00 corporation. The "MIDGET" is a regenerative receiver, tuning 100 to 3000 meters! !! And the price—O, Boy! It's in our new catalogue.

APPARATUS THAT IS WORTH WHILE
Wake up, gentlemen—We are on the map

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AT 145th ST. & BROADWAY, NEW YORK
IS THE PLACE TO BUY RADIO PARTS

Aerial Wire #14 pure copper	45c lb.
Western Electric Phone Cords, They Are Worth Double	$0.55
Series—Parallel Switches	$0.83
Telegraph Keys ¼KW	$1.49
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AMERICAN ELECTRIC & WIRELESS SUPPLY CO.

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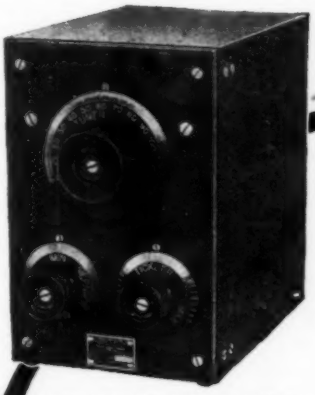
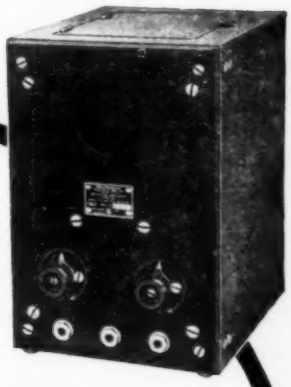
WESTINGHOUSE
Radio Receiving Equipment



Type RA Short-Wave Tuner
Style 307189—180-700 Meters

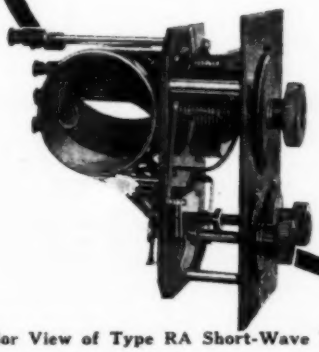


Type DA Detector Amplifier
Style 307190—2-stage, 3 tubes
Audio Frequency

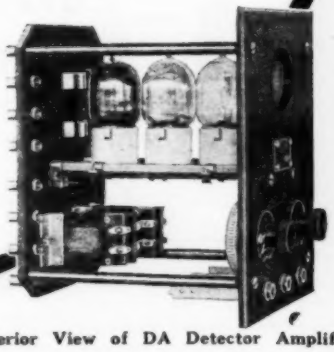
THIS high-grade Westinghouse regenerative Tuner, and tube detector amplifier embody the latest ideas of two noted radio engineers, Edwin H. Armstrong and Frank Conrad.

This apparatus provides a most efficient set for telegraph and telephone reception over the amateur and normal ship wave length ranges.

Simple in Design—Easy to Operate—Single-tuning Circuit
Highly Efficient



Interior View of Type RA Short-Wave Tuner



Interior View of DA Detector Amplifier

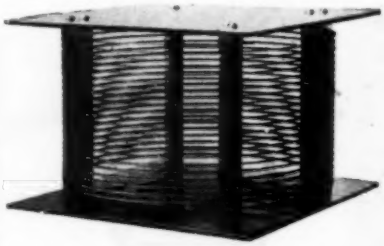
Our Radio Folder No. 4446 will interest you.—Ask your dealer for a copy
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
EAST PITTSBURGH, PA.

Westinghouse

C-W C-W C-W C-W C-W C-W C-W C-W

Prepare for the bad radio season by installing your CW outfit now. It will carry thru summer static and is ideal for relay work.

OUR C-W CATALOG WILL BE READY ABOUT MARCH 15th, SEND FOR YOUR COPY NOW.



OUR NEW C-W CATALOG WILL BE THE MOST COMPLETE AND BIGGEST — CW ONLY.

CW Inductance No. CW-100 shown above, mounted on Formica exclusively—25 turns edgewise copper strip 3/16 x .050" complete with connection clips, **$10.00.**

Send 15 cents for catalog, which amount may be deducted from first order of One Dollar or more.

"8ZV" WIRELESS MANUFACTURING CO. "8ZV"

CANTON, OHIO

Back To Old Prices

Parkin Rheostat

5000 Sold Last Year at $1.00

NOW REDUCED TO

75 Cents

Due to the general drop in the prices of raw material and to our large production, we have been able to reduce all our prices to their pre-war level, and in some cases even lower. New catalog, No. 4, listing our complete line sent free.

Here are a few of the items:

No.		Postpaid
31	Audion panel with rheostat and B Bat. Switch	$8.00
43	45 Volt Large B Battery	5.00
50	Parkin .001mf Variable Condenser, unit only	1.50
51	Parkin .001mf V.C. with knob and pointer	2.00
52	Parkin .001mf V.C. with knob and 3" dial	2.50
53	Parkin Molded Bakelite Fixed Condenser	.70
UV-200	New Radiotron Vacuum Tube	5.00

DEALERS—If you are not on our mailing list, write for new catalog and discounts.

PARKIN MFG. CO.

San Rafael, Calif.

R KLAUS D I O

THE KLAUS RADIO CO. ANNOUNCES

A further extension of its organization, under competent management, to give technical advice to wireless amateurs and experimenters

We Want to Serve You

AMATEURS

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The Klaus line embodies the latest developments in the wireless art. It will pay you to write for our proposition.

KLAUS RADIO CO.

EUREKA, ILL.

"SIGNALS QSA"

That's what the users of HURADIO VARIOMETERS say.

These new type of variometers are bringing in the results.

We guarantee them to satisfy any Radio Man. Proof that these variometers are bringing the results is the steadily increasing sale of them. For bringing in C.W. and Radio Telephone they are without a peer.

ELECTRICALLY PERFECT **DISTRIBUTED CAPACITY NIL** **MECHANICALLY PERFECT**

Owing to increased sales and production we are able to reduce the retail price.

HURADIO VARIOMETERS, without knobs and dials..... $5.50 each
VARIO-COUPLERS without knobs and dials..... 5.50 each
We can furnish AMRAD knob and Dial, at..... .80 each

IMMEDIATE DELIVERY GUARANTEED

C. W. CONDENSERS

The tremendous increased use of C.W. transmitters has "shown up" the weakness of the present type of condensers and forced the demand for a PUNCTURE PROOF CONDENSER for filter purposes. Your condenser **must** stand up and not "blow up" in smoke; **must** have a lower power factor loss; **must** smooth the ripples on your rectified A.C.; **must** decrease your generator hum to a minimum; **must** increase your radiation and not eat up half of your power.

WE HAVE IT **WE GUARANTEE IT**

Money back if the above MUST'S are not fully satisfied. Any breakdown replaced at **our cost.** Hundreds now in use, giving results beyond expectations.

PRICES, mounted and ready to hook up.

2 MFD. Guaranteed up to and including 1000 V. 250 Watts **$5.00** each
2 MFD Guaranteed up to and including 2500 V. 500 Watts, **$15.00** each
Prices quoted on request for higher voltages and capacities.

RADIOLECTRIC SHOP, Dept. Q. 919 Huron Rd., Cleve., Ohio

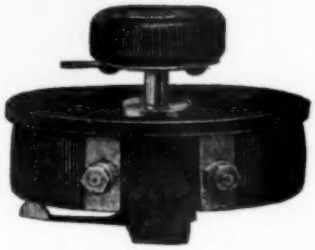
Correct C-W Modulation

The success of a radio telephone installation depends not only on the value of the antenna current, but also on how completely that current is modulated. Quality is also a very important feature. Now that satisfactory transmitting tubes are available, we have designed a modulation transformer particularly for these Radiotron UV202 tubes. This transformer, which is similar in appearance to our new Type 231A Amplifying Transformer, is designed to give the maximum modulation which is possible without distortion. If you desire real results with your C-W set, we recommend that you try our Type 231M Modulation Transformer.

DESCRIBED IN BULLETIN 907Q

PRICE COMPLETELY MOUNTED $5.00

FILAMENT BATTERY POTENTIOMETER



For best detector operation, the Radiotron UV200 tubes should have a grid biasing A battery potentiometer. We have adapted our already well known Type 214 rheostat for this service. It has a resistance of 400 ohms and is equipped with extra terminal for potentiometer connection. Like the rheostats, it is made in back of panel, as illustrated, and front of panel models. Price, either model, $4.00. Do not forget that these rheostats are now made for the UV202 transmitting tube as well as for receiving tubes. Transmitting tube rheostat 2 ohms (sufficient for regulation on a 12 volt supply source), 2.5 amperes; receiving tube rheostat 7 ohms 1-5 amperes. Price, either size, $2.50.

DESCRIBED IN BULLETIN 904Q

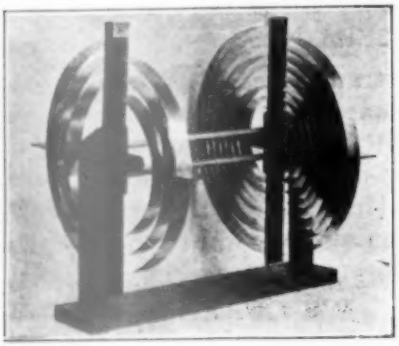
GENERAL RADIO COMPANY

MASSACHUSETTS AVENUE AND WINDSOR STREET

CAMBRIDGE 39, MASSACHUSETTS

Save Your Lost Energy

PRICE



14.50

T & H Oscillation Transformer Electrically and Mechanically Right.

Made with 1¼ or 3 in. ribbon on primary.

Ask your dealer for literature or send direct to

T & H RADIO COMPANY

ANTHONY, KANSAS

Catalog on Request

The Amplifone Loud Speaker is designed to operate with a two stage Vacuum Tube Amplifier. It does not require a battery for its operation. The Amplifone gives fine results on radio concerts as it does not distort. Finished in dull black. Dimensions 5"x7"x12". The handsomest and most efficient loud speaker at any price. Bulletin 106 R tells why.

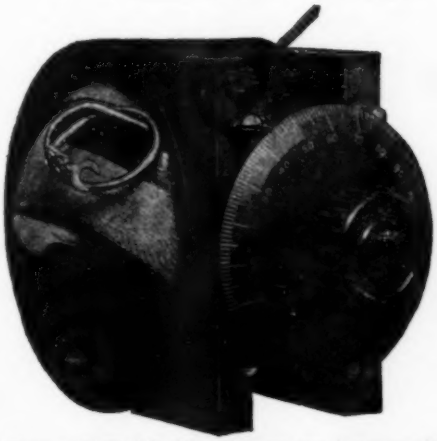
PRICE $20.00.

If your dealer cannot supply you send us his name.

F. M. DOOLITTLE CO.

817 Chapel Street, New Haven, Conn.

NEW APPARATUS



Type Z.R.V. Variometer has unit construction with bakelite shell and hard wood ball. Has low dielectric losses and a range of inductance of 1.25 mil henry maximum to .1 mil henry minimum. Is readily used on table or mounted on panels.

Complete with 3" dial and knob . .	**$6.50**
Without dial or knob	**$5.75**
Variocoupler of same construction	**$7.50**

A combination of beauty and convenience. One stage amplifier has binding posts for connecting two as a two stage amplifier. All binding posts on detector, amplifier and Regenerative set correspond for jumper connection.

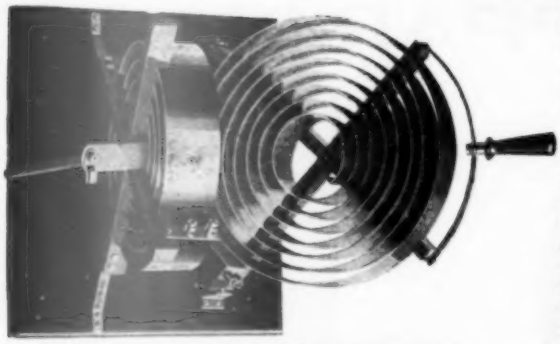
Tube Control Detector Panel, Z.R.D.	**$12.00**
One Stage Amplifier Panel, Z.R.A.	**$18.00**
Rheostat only	**$1.20**

Z.R.F. Regenerative Receiver consists of two Z.R.V. Variometers and a Coupler of similar construction, together with Grid Condenser and Grid Leak with Bakelite Panel machine engraved. Licensed under Armstrong U. S. Patent No. 1,113,149. This exactly matches our Tube Control and Amplifier panels with which it may be harmoniously used. Its range of wave length is 175 to 600 meters. **Price . . . $38.00**

Co-operate with your local dealer by helping him to carry a stock of Clapp-Eastham Co. apparatus, famous for its reliability during 13 years of continuous manufacture. If he doesn't carry our instruments send 6c stamps for our complete catalogs.

CLAPP-EASTHAM CO., 114 Main St., Cambridge, Mass.

DX-52 RADIATES



RELAY APPARATUS WITH A CHARACTER

QRV? for the summer static? Will that set that got thru this winter WORK THRU the summer barrage?

We suggest and offer DX-52 Oscillation Transformer knowing that it is unexcelled in the amateur relay world. It is a tonic to your set.

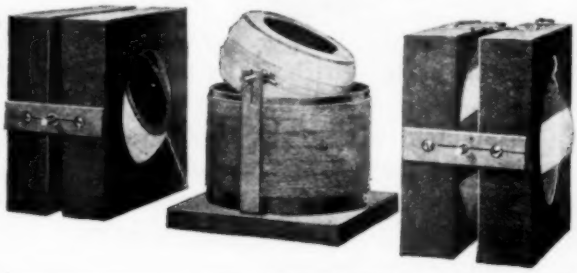
Specifications: Bakelite inslation thruout, 100% conductivity—heavy ribbon 2¾" wide on both primary and secondary, coupling easily and quickly varied while transmitting allowing a great saving of time in calling. HEAVY CLIPS, sturdy construction, a PRICE THAT'S RIGHT. Thoroly tested during 8ZR's transmission to 6EJ, 6AK and 7ZJ. Decide right now to put the DX-52 BOMB under your transmitter.

RELAY DX-52 OSCILLATION TRANSFORMER Price $25.00

For a BETTER RELAY regenerative set you can't go wrong on the following combinations:

DX-1 & DX-2 Grid and Plate Variometers $8.00
DX-6 Variometer on panel 12.00
DX-8 Audion control panel 10.00
DX-10 Audio control Cabinet 14.00
DX-3 Short Wave (200-600 meters) coupler .. $6.50
DX-7 Above coupler on panel 11.00
DX-9 Amplifier unit panel 15.00
DX-11 Unit amplifier in cabinet 19.00

DX-4 Regenerative set (unwired) on Formica or Bakelite panel $35.00
DX-5 Regenerative set (unwired) with panel and cabinet complete 40.00



Get the HABIT of expecting QUALITY AND SERVICE; We give it.

THE AMERICAN RADIO SALES AND SERVICE COMPANY

Great American Bldg., Mansfield, Ohio.

Testing Station 8ZR

DEALERS WRITE FOR ATTRACTIVE CONTRACTS

Something New in Variometers

Just the thing for your new Regenerative Set. The "Simplex" has a specially designed bearing, with heavy cotton covered wire, on forms made of thoroughly seasoned hard wood, treated with insulating varnish.

These features combined with neatness and ruggedness, make a very efficient and reliable Instrument.

Simplex Variometer, Price.....$6.00
Simplex Vario Coupler, Price.....$6.00

The Quaker Light Supply Co.

728 Arch St., Philadelphia, Pa.

Attention of Mr. H. J. Dunbar.

YOU CAN NOW BUY THIS REMARKABLE BOOK

THE

Alexanderson System

FOR

Radio Telegraph and Radio Telephone Transmission

By Elmer E. Bucher

10¾x8¼, 56 pages, 38 illustrations and diagrams. Bound in heavy antique paper cover. **Originally Intended for Private Distribution**—the requests for copies became so insistent that consent was finally given for a public sale. The only complete description of this famous system as installed in the New Brunswick station is in this book.

Here, for the first time, you get the details of the invention that revolutionized trans-Atlantic wireless transmission—the one producing such a wonderfully clear note that foreign governments sent their experts to investigate and who, on the reports of these experts, ordered the alternator for their own stations.

SPECIAL INTRODUCTORY OFFER

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Regular Price $3.75.

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Incorporated

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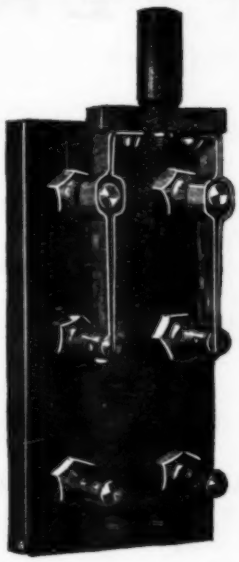
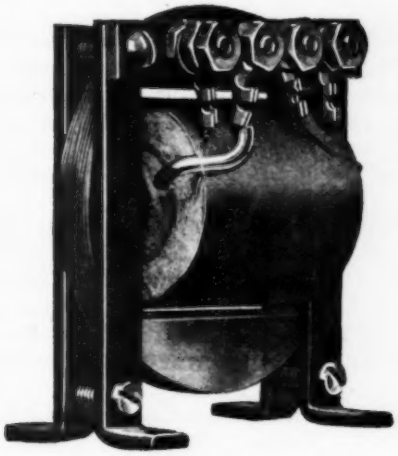
NEW APPARATUS



(Illustration exact full size)

Z. R. S. Miniature knife switch is supplied unmounted only, for panel mounting and will harmonize with other fine products of the instrument maker. There is nothing else like it on the market.

Double pole, single throw	80c
Double pole, double throw	90c



Modulation transformer	$4.50
Choke coil .8 Henry	$3.75
Amplifying transformer	$4.00

All these are mounted as shown in the illustration and will give you results second to none.

Type Z. R. F. D. A. Regenerative Receiving Set has a range of wave lengths of 175 to 600 meters and is designed exclusively for those discriminating purchasers who require the very utmost in long distance short wave reception. It comprises a very handsome oak cabinet with hinged cover and Bakelite panel on which are mounted Variocoupler, two Variometers, grid condenser, Variable Condenser detector elements and a two stage amplifier.

This set is very satisfactory for radio telephone reception and is complete except bulbs, telephones and batteries.

Z. R. F. D. A. Set $140.00
Z. R. F. D. Set, same as above without amplifiers 85.00

Licensed under Armstrong U. S. patent #1,113,149

Co-operate with your local dealer by helping him to carry a stock of Clapp-Eastham Co. apparatus, famous for its reliability during 13 years of continuous manufacture. If he doesn't carry our instruments send 6c stamps for our complete catalogs.

CLAPP-EASTHAM CO., 114 Main St., Cambridge, Mass.

SPECIAL OFFERS

These prices effective until May 15th.

Perfection Tubular Tron Panels and Parts	$5.95
Clapp-Eastham 43 plate condensers in metal cases	4.95
Goose-neck bakelite VT sockets	1.75
Murdock #367 Variable condensers	3.95
Murdock #368 Variable (interior only)	2.95
DeForest Honeycomb or Duo-Lateral Coils (fully mounted—Sizes 25 to 500)	20% discount
DeForest D101 Galena Detector	$1.95
DeForest CV500 Variable Condenser—(complete)	4.95
LC-100—Triple Coil Gear Mount	7.25
UD-100—Unit Panel Galena Detectors	3.45
S-200—Anti-Capacity Switch—4 pole	8.15
U-200—"A" battery Switch annd Telephone Jack on standard Unit Panel	2.65
Amrad Induction Coil and ¼ K.W. Quenched Gap Combination Value $47.75 Now	35.75

(Include Postage Charges When Ordering)

(Send 4c. in stamps for our 55 page catalog.)

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611 BEST BLDG., Main Office, ROCK ISLAND, ILL.

Averaged 82% out of a possible 90%

The thirteen students who made this record were not "picked" or specially "coached", but taken in the order in which they graduated and appeared for government examination.

MASSACHUSETTS RADIO AND TELEGRAPH SCHOOL

18 Boylston Street, Boston, Mass.

Tel Beach 7168

R. F. Trop *G. R. Entwistle*

Thirteen graduates of the MASSACHUSETTS RADIO and TELEGRAPH SCHOOL during the ***six weeks*** examination period between November 1st and December 15th, 1920 established this record on their U. S. GOVERNMENT EXAMINATIONS for ***first grade*** Commercial Operator's license. Their average attendance was 5.1 MONTHS.

The fact that a new United States Radio Inspector did the examining, using new and original questions unfamiliar to the graduates, speaks all the more favorably of our system and methods.

To produce ***thirteen*** graduates, who, within the short period averaging a little ***over five months,*** obtained such a high average, is the best way we know of to convince you of the merits of this school. ***Results count.***

Names, addresses and full data sent on request to anyone.

Why not avail yourself of this service. It costs no more. ***Send for free literature.***

"EVERYTHING IN RADIO"

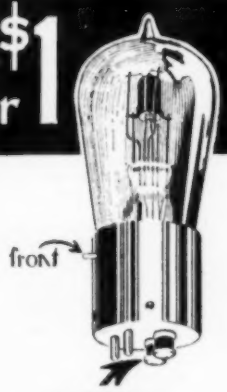
WESTERN RADIO ELECTRIC COMPANY

SEND FOR OUR MARCH

STOCK BULLETIN AND PRICE LIST

550 South Flower Street, Los Angeles, Cal.

3 for $1 — PROTECT YOUR VACUUM TUBES INDEFINITELY!



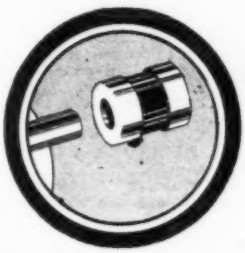
"A BULB WORTH HAVING IS WORTH SAVING"

Because it is impossible for destructive amperage to reach the delicate filaments of your expensive vacuum tube a few cents protects the heart of your set when equipped with the

RADECO SAFETY FUSE

Pat. Pending.

FOR VACUUM TUBES



Slips directly on filament terminals of any standard bulb and does not distort springs of your socket. It does not interfere with efficiency of your set but protects it indefinitely.

Carrying capacity 1, 1¼, 1½, 2, 2½ and 3 amp. Size ¼ inch over all.

RADECO SAFETY FUSES are equally valuable in C.W. Work preventing injury to meters or filaments resulting from shorts or abnormal conditions.

THREE FOR $1

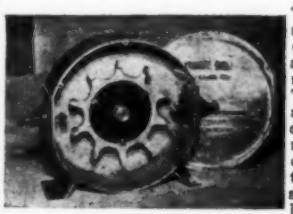
35c Each

ORDER BY MAIL

If your dealer cannot supply you, send cash—certified check or money order. Your order filled by return mail.

ROTARY QUENCHED SPARK GAP, $20.00 Postpaid.

With Universal 110 V. Motor Attached, $25.



The advantages of a noiseless, super-efficient rotary gap are now within the reach of all.
The casing is of cast aluminum with the cover machined to make an airtight enclosure for the extremely light weight aluminum rotor, with bakelite insulation. Stationary electrodes are of copper with bakelite insulation.

Chelsea Dial Indicator $1.00

3½" diameter—moulded of real Bakelite — accurately centered, and at right angles to the ¼" brass insert hole.

Cunningham C-300 Audiotron $5.00

44 V. Variable "B" Battery $3.60

Include postage on 4 lbs.

Complete in handy wooden case and adjustable phosphor bronze "Jiffy" connectors. Better than block batteries—if one 4.4 V. unit weakens prematurely, it can be removed and replaced—thereby not impairing total voltage, which makes this the best battery value to be had at any price. Set of 10 Renewal Units, 44 volt, **$3.10 postpaid.**

GROUND WIRE 8c. Per Foot

$7.00 PER 100 FEET.

No. 4 solid copper—rubber covered—triple braid —include postage on 20 lbs., per 100 ft.

Standard VT Socket . . . $1 Postpaid

Improved Contact Type
Copper foil condenser 35c p.p.

AERIAL WIRE 1c. Per Foot

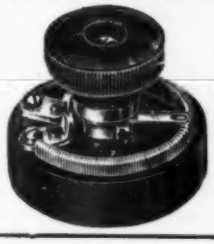
7 strands No. 22 copper—tin plated to prevent oxidation. Maximum radiation and strength. Include postage on 15 lbs. per 1000 ft.

Lightning Switch . . . . . Price $4.00

100 Amp.—600 Volts.

PARAGON RHEOSTAT

$1.75 Post Paid



For back of panel or table mounting, 2⅛ in. dia., 6 ohms, 1½ amps.

DeForest CV500A Variable Condenser (no knob or pointer). A few left at

$3.75

$10 General Radio Hot Wire Ammeters (flush type $7.75

Radio Equipment Co., 630 Washington St. 4th FLOOR Boston, Mass.

QUALITY--SERVICE--PRICE

AMPLIFIERS (Without Tubes)

Grebe single stage	$25.00
Grebe single stage with control	50.00
Grebe two stage	50.00
Grebe two stage with control	75.00
Clapp-Eastham one stage panel	18.00
Acme Y-2 single stage	13.00

AMPLIFIER PARTS

Moorhead VT Amplifier tube	$7.00
Murdock VT Receptacle	1.00
Acme new mounting transformer	5.00

AUDION CONTROLS (Without Tube)

DeForest P-100 cabinet	$67.50
DeForest P-400 cabinet	13.25
DeForest P-401 without cabinet	10.90
Grebe tube unit only	12.50
Clapp-Eastham control panel	12.00
Paragon control panel	6.00
Acme detector unit	10.00

AUDION CONTROL PARTS

Moorhead electron relay	$6.00
Radiotron detector tube	5.00
Radio service socket	1.10
G. A. Condenser and Leak	.50
Paragon panel mounting rheostat	1.75
Federal single circuit jack	.70

B. BATTERIES

Cyclone 22½ volt small	$1.25
Cyclone 22½ volt large	2.40
Eveready 22½ volt small	2.25
Eveready 22½ volt large	3.50
Eveready box of 10 flashlight cells, 45 volt	3.50

Consolidated Radio Call Book, 3rd Edition, containing all amateur calls, in addition to the usual commercial listings—**$1.50.**

Largest Radio Catalog in the world

Kelly & Phillips new 200-page catalogue lists all the apparatus available for every radio need. It contains valuable information and data that you will use every day. Sent, at once, for 25 cents, in stamps or coin, which will be credited to the first order of $2.50. (Send for your copy NOW!

STORAGE BATTERIES

Paul M. Marko & Co. of Brooklyn, N. Y., having reduced their prices 10% to us we are reducing list prices accordingly.

6 v. 40-60 amp. hour	$17.10
6 v. 60-80 amp. hour	21.60
6 v. 80-100 amp. hour	32.60
6 v. 100-120 amp. hour	36.00
8 v. 20-40 amp. hour	18.70
8 v. 60-80 amp. hour	32.60
8 v. 80-100 amp. hour	39.40

VARIABLE CONDENSERS

Chelsea .0011 m.f. encased	$5.00
Chelsea .0006 m.f. encased	4.50
Chelsea .0011 m.f. interior with dial	4.75
Chelsea .0006 m.f. interior with dial	4.25
Murdock No. 366 43 plate	4.75
Murdock No. 366	4.75
Murdock No. 368 23 plate	3.75
Murdock No. 368 interior	3.25
Murdock .001 panel type	4.00
Murdock .0005 panel type	3.25

TELEPHONE RECEIVERS

Murdock 55 2000 ohm set	$4.50
Murdock 55 3000 ohm set	5.50
Brandes "Superior"	8.00
Brandes "Transatlantic"	12.00
Brandes "Navy type"	14.00
Baldwin Type "C"	16.50
Baldwin type "E"	20.00

PARTS FOR COMPLETE RECEIVING SET

Murdock loose coupler	$9.00
Murdock No. 368 condenser	3.75
Murdock crystal detector	.70
Murdock phone condenser	.70
Murdock 2000 ohm receivers	4.50
Complete equipment	$18.65

UTILITY RECEIVER PARTS

Unit coil holder	$2.00
600 meter coil	1.70
Murdock .001 condenser	4.75
DeForest crystal detector	2.60
G. A. phone condenser	.35
Murdock 2000 ohm phones	4.50
	$15.90

AUDION RECEIVER PARTS

Bakelite panel	$1.50
200 meter coil	1.80
Chelsea Condenser	4.75
Binding posts	.50
Acme detector unit	10.00
Brandes Superior phones	8.00
	$26.55

Think of **KELLY & PHILLIPS** *for the job*

312 Flatbush Ave., *Radisco Agency* Brooklyn, New York

Chelsea Variable Condensers

(Die Cast Type)

No. 1—.0011 m.f. mounted	$5.00
No. 2—.0006 m.f. mounted	4.50
No. 3—.0011 m.f. unmounted	4.75
No. 4—.0006 m.f. unmounted	4.25
Bakelite dial only	.75

Top, bottom and knob are genuine bakelite, shaft of steel running in bronze bearings, adjustable tension on movable plates, large bakelite dial reading in hundredths, high capacity, amply separated and accurately spaced plates.

Unmounted types will fit any panel and are equipped with counter-weight.

Purchase from your dealer; if he does not carry it, send to us. Bulletin sent upon request.

Chelsea Radio Co., 15 Fifth St., Chelsea, Mass.

Manufacturers of Radio Apparatus and Moulders of Bakelite.

Best of Everything in Radio Apparatus and Parts.

Send Stamp for Catalog "Q"

J. H. BUNNELL & CO.

32 Park Place, New York

"Hytone"

BUZZERS

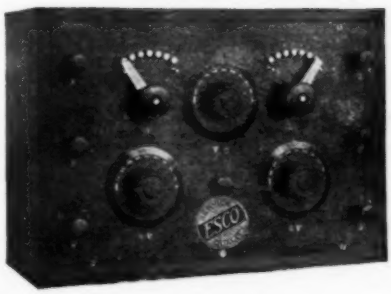
for radio work. External tone adjustments. Pure silver contacts.

Price 60c postpaid

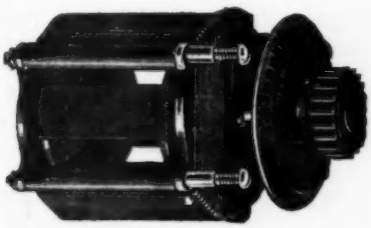
AJAX ELECTRIC CO.

Palmer St., Cambridge, Mass.

A Regenerative Receiver and Radiophone



THE SET



THE VARIOMETER

Our ESCO REGENERATIVE RECEIVER has already been advertised in the March and April issues of this magazine and in the meanwhile has gained a national reputation. It is conceded to be the best set of its kind for all kinds of reception and is especially adapted for CW and all Radiophone reception due to the fact that it tunes very sharply. For long distance work it is unexcelled.

Our laboratory force during the past few months have been experimenting upon a new use of the ESCO REGENERATIVE RECEIVER and have finally perfected a method whereby with the use of a microphone and simple detector unit, speech and music can be transmitted over distances ranging from 10 to 45 miles. This is not mere idle talk but an accomplished fact. Of course we consider the hook-up of value and it will be available only to each purchaser of an ESCO set.

Summer is practically here, the season when radio operations begin to wane. However it has been found that atmospheric disturbances during the hot season do not affect CW nearly as much as spark transmission and reception. In fact many experts claim that radiophone work can be carried on almost as well as during the cold weather. Here, then, is where the ESCO receiver will show its manifold abilities For the set is beyond comparison at receiving all CW stuff, bringing in the messages loudly and clearly over long distances. In addition it can be used as a radiophone. Hence we have a combination sending and receiving outfit at a moderate price of $50.00 f.o.b. Columbus, O. Is it not worth your while to consider the purchase of one of these marvelous sets?

ESCO variometers and vario-couplers sell at the following prices:

Variometer with dial	$9.50	Vario-coupler with dial	$10.00
Variometer without dial	$8.50	Vario-coupler without dial	$9.00

SPECIAL UNTIL SEPT. 1st, 1921.

During the summer months we offer our regular 1K.W. transmitting key with the ¼ inch contacts of Sterling silver at the reduced price of $3.29 postage prepaid. This key is very sturdily built and will hold up to and including 1K.W. very easily. The special price holds good only to Sept. 1st.

Send 15c for our large illustrated catalogue with supplement and also literature of our ESCO REGENERATIVE RECEIVER. This amount will be refunded on your first order for $1.50 or over. High printing costs make free distribution impossible.

The Electrical Specialty Company

DEPT. M., 48-50 SO. FRONT ST., COLUMBUS, OHIO

The first of our

New Series of Bulletins

On Radio Apparatus is now ready. Bulletins describing more complete and advanced equipment will soon follow.

In the meantime, send five cents for the first Bulletin No. 10, which will indicate the beginning of the line which we will offer to discriminating amateurs, experimenters, colleges, etc.

PACENT ELECTRIC COMPANY

(Selling Agents)

150 Nassau Street, OR New York, N. Y.

WIRELESS IMPROVEMENT COMPANY

(Manufacturers)

66 York Street, Jersey City, N. J.

A Full Line of Radio Apparatus

We have everything you need. Below are a few items from our large stock. Watch this space for a complete stock list.

POWER TUBES

A-P 5 watt	$7.50
Cunningham C302 5 watt	8.00
Cunningham C303 50 watt	30.00
Cunningham C304 250 watt	110.00
DeForest Singer Type 37 watt	24.00
DeForest Oscillion 250 watt	60.00
DeForest Oscillion 500 watt	75.00
DeForest Oscillion 1000 watt	150.00

We have all the necessary material for CW outfits.

350 volt generators $20.00

6" diam. 1/8" wall Formica Tubing Per ft. 2.75

Send for bargain list.

The above prices are F.O.B. St. Paul.

PIONEER ELECTRIC CO.

137 East Fifth St., St. Paul, Minn.

MAGNET WIRE

We are prepared to furnish best grade magnet wire on ¼ and ½ lb. spools at the following prices.

PRICE PER ¼LB. SPOOL

Size B & S Ga.	Single Cotton	Double Cotton	Single Silk	Enameled
No. 22	$0.56	$0.68	$0.62	$0.45
No. 24	.60	.77	.67	.47
No. 26	.65	.88	.71	.49
No. 28	.75	1.10	.85	.52
No. 30	.85	1.24	.97	.53
No. 32			1.15	.55
No. 34			1.52	.59
No. 36			1.77	.69

Price of ½ lb. spools double above list.

All prices are net and include cost of spool and delivery charges via Parcel Post to any Post Office address in the United States; safe delivery guaranteed.

Send for Circular 21-A giving prices on other sizes, insulations and quantities of Magnet Wire. This circular lists "WIRE FOR EVERY WIRELESS PURPOSE".

KEYSTONE WIRE CO.

P. O. BOX 120, SCRANTON, PA.

You Have Been Looking For A

Really Good Microphone

FOR YOUR RADIOPHONE

Here It Is.—Built For Your EVERY PURPOSE AND It Will GIVE You RESULTS That Will SATISFY

No. 260-W
Hand Microphone
A handsome and very practical instrument.
Price - - $7.00
Shipping weight 2 lbs.

No. 261-W
Desk Microphone
An excellent instrument for desk use.
Price - - $6.50
Shipping weight 3 lbs.

The 260-W and 261-W are fitted with 6′ cords.
Fitted with No. 1428-W plug, $2.00 extra.

No. 262-W
For panel mounting. Adjustable pony arm.
Price - - $5.25
Shipping weight 2 lbs.

No. 263-W
For panel mounting. Full nickel plated.
Price - - $5.25
Shipping weight 2 lbs.

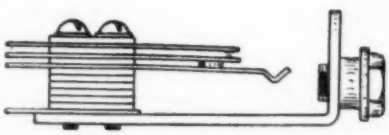
The 262-W and 263-W are fitted with connecting cords.

Automatic Filament Control Circuit

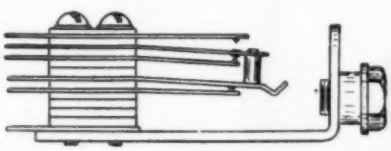
(PAT APPL'D FOR)

USING FILAMENT CONTROL JACKS

A REAL STEP IN ADVANCE



No. 1435-W
PRICE - - $1.20 Each



No. 1438-W
PRICE - - $1.50 Each

Ask your dealer for them—if he does not have them tell us his name or write direct.

FEDERAL TELEPHONE AND TELEGRAPH CO.

BUFFALO, N. Y.

"Federal" Radio Accessories Are The Standard

Do You Know How Much Current You Are Putting Into Your Aerial?

Flange diameter 3¼ inches
Body diameter 2⅞ inches
Scale length 2.35 inches.

Weston

Model 425

Thermo-Ammeters

will keep you informed of this and help you find out why your set does not give results. EVERY AMATEUR SENDING SET should be equipped with one of these ammeters. They occupy very little space and harmonize with all other standard radio equipment. Their characteristics make them ideal for radio service. They are commercial instruments which sell at a cost very little above that of inferior imitations. The progressive amateur wants the best instruments available and will purchase Weston Instruments. May we send you literature?

WESTON ELECTRICAL INSTRUMENT COMPANY
158 Weston Ave., Newark, N. J.
BRANCHES IN ALL PRINCIPAL CITIES.

CONNECTICUT

HIGH GRADE RADIO APPARATUS

CONNECTICUT Head Receivers

Adopted during the world war as United States Government standard. A high grade set, justly popular among operators. The receivers are durable and of first quality. Steel wire bands bound with webbing, specially light, but equally strong. Readily adjustable to any head.

2000 ohms with 6 foot cord.....$6.00
3000 ohms with 6 foot cord..... 6.50

CONNECTICUT Transmitters

Mechanically and electrically correct. Every transmitter fitted with finest imported mirror carbon electrodes, and subject to micrometer inspection.

Transmitter with short adjustable arm.....$5.00
Hand Transmitter with cord.....11.00

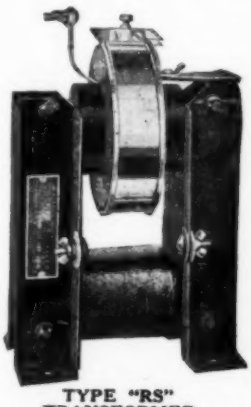
CONNECTICUT Variable Condenser

This new condenser has met wonderful success. Send for booklet with full information. Portable or panel type **$6.50.**

CONNECTICUT TELEPHONE & ELECTRIC COMPANY
Meriden Connecticut

Important Reductions in Prices of

Thordarson Apparatus



TYPE "RS" TRANSFORMER

Type "RS" Transformers

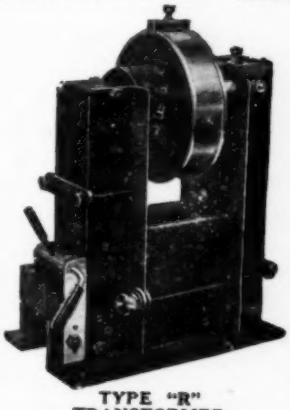
A non-resonant transformer with a lower secondary potential designed to give you the highest possible power factor.

1 KVA 15000 VOLTS	$30.00
½ KVA 10000 VOLTS	20.00
¼ KVA 8000 VOLTS	15.00

Type "R" Transformers

The famous resonant transformer affording the highest practical voltages.

1 KVA 25000 VOLTS	$40.00
¾ KVA 10000 VOLTS	28.00
½ KVA 10000 VOLTS	22.00



TYPE "R" TRANSFORMER

Other Thordarson Equipment

POWER CONDENSER (.0018-.009 MF)	$25.00
OSCILLATION TRANSFORMER	10.00
R8 ROTOR (8 TOOTH)	5.00
R16 ROTOR (16 TOOTH)	5.00
R12 ROTOR (12 TOOTH)	3.00

(Specify diameter of motor shaft when ordering rotors.)

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Thordarson Electric Manufacturing Co.

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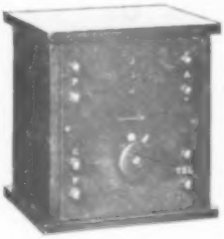


The "Miraco" Vacuum Tube Detector

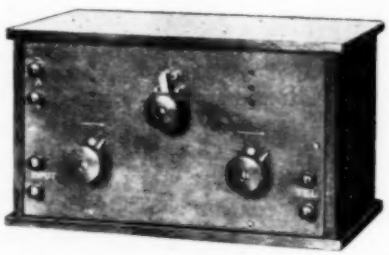
The new "MIRACO" Detector contains features not found in others at double the price. There is ample space in the hinged covered cabinet for "B" batteries and additional binding posts on the back of panel enable the operator to connect them inside.

$7.85 Postpaid.

Complete ready to use, only

The "Miraco" Two Stage Amplifier

The "MIRACO" Two Stage Amplifier is distinguished for its unusual amplification and quietness in operation. May be operated from same "A" and "B" battery used for your detector. But cabinet includes a shelf for additional "B" batteries for the amplifier. A switch automatically changes the circuit from one to two stages of amplification.



Complete ready to use, only **$29.50** Postpaid.

These "MIRACO" units are ideal for radio-telephone and telegraph work during the static season.

THE MIDWEST RADIO CO., Dept. E., 3423 Dury Ave., Cincinnati, O.

REDUCED PRICES

On Wilcox Variometer and Regenerative Receiver Parts.

5AP1—Wooden parts for variometer	$2.00
5AP2—Complete parts for variometer with dial	4.25
5AP3—Complete parts for variometer less dial	3.00
5A Variometer assembled with dial	6.50
5A Variometer assembled without dial	5.25
5B Variometer—A new product, assembled and mounted on standard 5"x5" panel	8.00
1CP1 Variocoupler parts complete	5.00
1C1 Variocoupler rotor	1.00
1C Variocoupler, completely assembled on standard 5"x5" panel	8.00

Build your own regenerative receiver

Thousands of amateurs have done so with the aid of WILCOX parts. You can do the same and save money. Buy 2 #5B Variometers and 1 #1C Variocoupler and you'll only have to connect them together. Or buy some of the other parts and assemble them on your own panel. Wooden parts include winding forms and clear instructions for assembling accompany all complete sets.

5c Stamps or coin brings you our catalog listing all kinds of standardized parts.

THE WILCOX LABORATORIES

Lansing, Dep't. H., Mich.

Why try to "read 'em and—weep"? Use a K-52 short wave set, and weep no more. We also carry a complete line of parts for short wave sets.

J.J.N. Variometer	$4.50
J.J.N. Vario-coupler	5.00
EMCO Variometer	7.00
K.R. EMCO Vario-coupler	6.50

Send for Catalogue "Q 15"

DAVID KILLOCH COMPANY

57 Murray Street

New York City, N. Y.

RADIOTRONS

"A TUBE FOR EVERY NEED"

Radiotrons are now recognized as the amateur's and experimenter's standard for Radio detection, amplification and power work. They are available at established Radio dealers throughout the United States.

Scientifically designed and manufactured in the country's largest lamp factories, Radiotrons come to the experimenter with uniform and dependable characteristics.

One of the following tubes is certain to meet your requirements

U. V. 200	U. V. 201
DETECTOR	AMPLIFIER
$5.00	$6.50

U. V. 202	U. V. 203	U. V. 204
POWER TUBE	POWER TUBE	POWER TUBE
5-Watt	50-Watt	250-Watt
$8.00	$30.00	$110.00

The Radio Corporation's tubes are covered by patents dated November 7th, 1905, January 15th, 1907, and February 18th, 1903, as well as by other patents issued and pending. Tubes licensed for amateur and experimental use only. Any other use will constitute an infringement.

Your dealer has Illustrated Bulletins on Radiotrons, or write direct to

SALES DIVISION, COMMERCIAL DEPARTMENT,
SUITE 1803

RADIO CORPORATION OF AMERICA

233 BROADWAY

NEW YORK CITY

Oscillation Transformer.

Special Type "S" $20.00

Of neat and durable construction, they are designed to meet the present need of a correctly built and easily adjusted transformer even while sending. A feature of importance is the fact that it is impossible for the ribbon to dislodge itself from the mounting.

The ribbon is of brass mounted on bakelite strips which in turn are placed on a heavy brass center piece supported by hardwood cross strips. Electrically and mechanically, they are built correct.

Our regular Type R oscillation transformer consists of four turns of 2 in. ribbon on the primary and eight turns of 1 in. ribbon on the secondary. The diameter of the ribbon spirals is 18 in. over all. This transformer will improve any station.

Price $16.00, f.o.b. Chicago. (Ship. Wt., 20 lbs.)

There are cases where a larger oscillation transformer is required because of higher power or wave-length, and we have therefore designed a special Type S which consists of four turns of 3 in. ribbon on the primary and 12 turns of 1 in. on the secondary. It has been found that by the use of three inch ribbon on the primary, the antenna radiation has been considerably increased over that obtained with a smaller one.

Type "S" Price $20.00, f.o.b. Chicago.
(Ship. Wt., 25 lbs.)

RAVENSWOOD RADIO DISTRIBUTING CO.

Manufacturers and Distributors

1917 Warner Ave., Chicago, Ill.

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RADIO AMATEURS
AND OUR NEIGHBORS

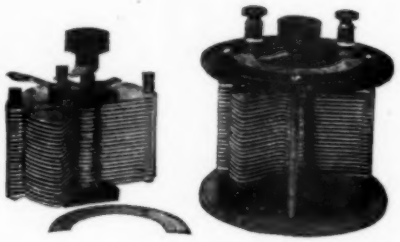
We have a complete line of radio apparatus and represent over thirty radio manufacturers. Write us for prices.

POSTAGE PAID

Duluth's Oldest Electrical Store

BURGESS ELECTRIC CO.

310 W. FIRST ST., DULUTH, MINN.



THE "ILLINOIS" VARIABLE CONDENSER

The Condenser with "Star Spring" Tension

MADE RIGHT - STAYS RIGHT

Hard Rolled Aluminum Plates

These condensers are made by a watch mechanic schooled in accurate workmanship and who can't get over the habit of critical inspection.

Three Styles; No. 1. Panel; No. 2. Open Type as shown; No. 3. Fully Encased. Anti Profiteer. Less than pre-war prices. Fully assembled and tested.

Style	No. 1	No. 2	No. 3
67 Plates,	$7.00	$	$
43 "	3.50	4.50	4.75
23 "	2.75	3.75	4.00
13 "	2.25	3.25	3.50

Money back if not satisfied. Just return condenser within 10 days by insured P.P.

With Style No. 1, we will, if desired, furnish 3 inch Dial with large knob, instead of Scale and Pointer.

Extra Price 75 cents.

Sent Prepaid on Receipt of Price.

Except: Pacific States, Alaska, Hawii, Phillippines and Canal Zone, add 10c. Canada add 25c.

Foreign Orders other than Canada not solicited.

Kindly note: We issue no Catalog, and make no "trade discounts". We set our prices at the lowest limit, and leave the "middle man" out for the sole benefit of the "consumer".

F. G. JOHNSON, 625 Black Ave., Springfield, Ill.

Canadian Radio Experimenters
Lateral Wound Coils.

TURNS	APP. WAVE LENGTH	PRICE
25	130.375	$0.55
40	225.575	.60
75	240.740	.70
100	460.1480	.80
175	750.2400	1.00
325	1375.4500	1.25
550	2250.7700	1.50
750	3000.11200	1.75
1200	6000.20000	2.50

Special sizes to order

Special discount to dealers

Plugs & Bands with screws for coils	$0.75
C. W. Inductances	2.00
C. W. Inductances	7.50
Transmitters for radio purposes	3.50
Vario-Couplers & Variometers	4.25
Milliammeter and Hot Wire Meters	

Send 5c for 30 page catalogue

J. M. PAQUIN

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RESULTS ! !

If you are interested in studying Commercial Radio under the most advantageous conditions, the RESULTS accomplished by the Eastern Radio Institute should merit your immediate enrollment.

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The Eastern Radio Institute was founded in 1913 and is now over six years older than any other Radio and telegraph school in New England.

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The Eastern Radio Institute moreover has given instruction at this date to over 4000 different students, and has enrolled, graduated and placed more Commercial Radio operators than all other schools in New England combined!

WE HAVE ACCOMPLISHED SOMETHING!

Graduates of the Eastern Radio Institute have actually secured 90%, 89.9%, 89.8% etc. out of a possible 90% in their Commercial Radio operators first grade examination.

WE KNOW HOW TO GIVE THE STUDENT PROPER TRAINING!

Successful graduates of the Eastern Radio Institute are found in responsible radio positions all over the world. Why not be one? It costs no more!

Our latest, illustrated prospectus is free. If you cannot visit the Institute send for one. Remember our ORGANIZATION with over eight years of continued RESULTS and SUCCESS is behind every student who enrolls!

F. D. PITTS, Director.

All Your Friends Want to Hear that Radiophone Music

—but so many phones cannot be placed in the same circuit.

THE RADIO MAGNAVOX

will solve your problem and allow everyone to listen in. With suitable amplifiers the signals and music can easily be heard by all. Remember that full field current need not be used except for the very weakest signals, or when extreme volume is necessary.

Price **$45**

AT YOUR DEALER'S

Or

The Magnavox Co.

OAKLAND, CALIFORNIA

MAXIMUM VACUUM TUBE RECEPTION

To get maximum results in vacuum tube reception the headset must have an impedance approximating that of the V.T. The Navy Type N.H.I. is designed for this purpose. It has an impedance of 50,000 ohms at 800 cycles—over twice that of any other headset.

BRANDES
MATCHED-TONE
HEADSETS
100% Receiver Satisfaction

It is of the utmost importance for both telephones to be so matched in tone that they emit **exactly** the same note. Nothing is so apt to hamper the reception of weak signals, especially through interference, as badly-matched telephones. The Navy Type N.H.I. being a "BRANDES" product, is of course, most carefully matched in tone.

Navy Type

50,000 ohms A.C. Weight 9 oz. complete with headband and polarity indicating cord Price $14.00

HIGHEST-PITCHED notes can be heard with the Navy Type N.H.I. It will respond clearly to a wider range of frequencies than any other headset, and yet be superior in audibility. POLARITY—To keep the sensitiveness from being impaired by the demagnetization of the permanent magnets, the D.C. must pass through the receiver in the proper direction; this is provided for by the marked conducting cord, with which the Navy Type N.H.I. is equipped.

TRIAL OFFER

Send $14 for a Navy Type Headset. Try it for 10 days. If you don't find it the best headset you ever tried and are not entirely satisfied with it, send it back and your money will be refunded promptly.

Also Makers of:

Trans-Atlantic Headsets, 25,000 ohms, A.C. $12
Superior Headsets, 2000 ohms D.C. 8

Send 5c. for Catalog "F".

C. Brandes, Inc.

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Pacific Coast Distributors

RADIO APPARATUS

Distributors of Reliable Radio Apparatus to Schools, Colleges, Radio Clubs and Experimenters All Over the World!

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The Sign of Service!
All We Ask is a Chance to Prove It!

"PITTSCO"
Service Reaches All Over the World! Why Not Let it Reach You!

AMPLIFIERS

Amrad Type A one step	$21.00
Amrad VT det. and one step	34.50
Amrad Type A two step	39.50
Grebe RORE one step	25.00
Grebe RORL VT det. and one step with automatic filament control	51.00
Grebe RORK two step with automatic filament control	55.00
Grebe RORD VT det. and two step with automatic filament control	75.00

AUDION CONTROL PANELS

Amrad Type A in cabinet	15.00
Grebe RORA in cabinet with hinged cover, splendid value	12.50
Grebe RORH in cabinet with tickler connections	17.00
Acme Y-1 in cabinet	10.00
Paragon, latest type, moulded	6.00

"B" BATTERIES

No. 7623 Small Standard 22.5 V.	$1.50
No. 7625 Large Standard 22.5 V.	2.65
No. 7650 Variable Standard 22.5 V.	3.50
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No. C-2 Connecticut .001 mfd. panel mtg.	6.50
No. 3660 Murdock panel type .001	4.00
No. 3661 Murdock same as above but with knob, handle, etc.	4.25
No. 3662 Murdock, same as No. 3660 but with special knob, dial, etc.	5.00
No. 3680 Murdock panel type .0005 mfd.	3.25
No. 3681 Murdock, same as above but with knob, handle, etc.	3.50
No. 3682 Murdock, same as No. 3680 but with special knob, dial, etc.	4.25
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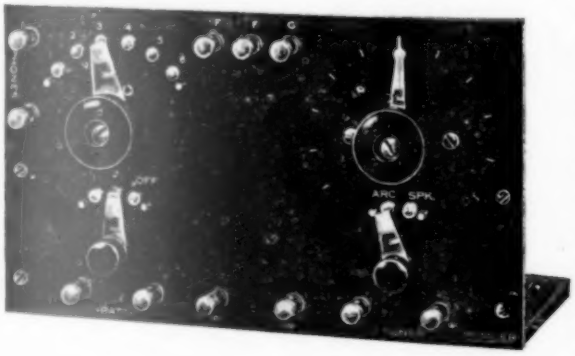

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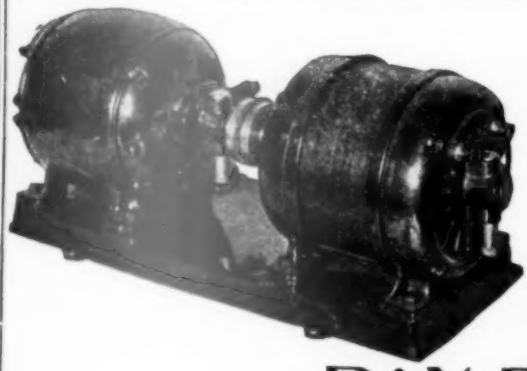

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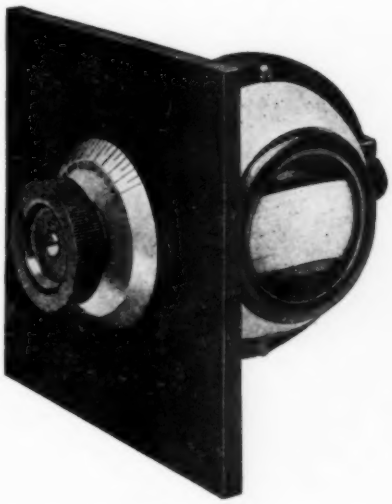

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2000 ohm	$4.50
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Type R. S. 7

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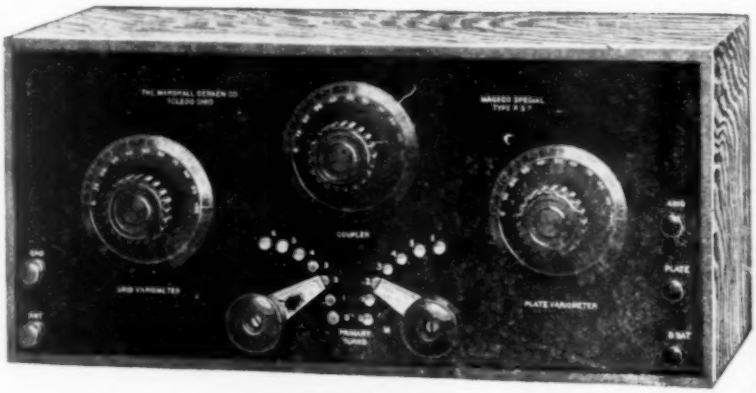

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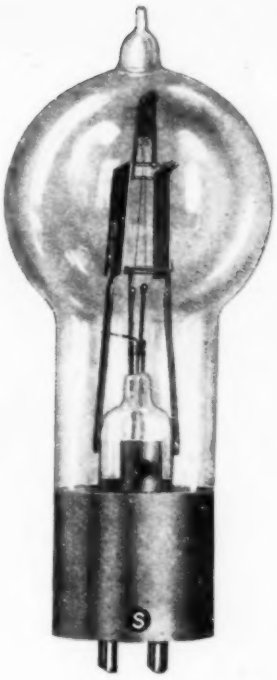

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The A-P Rectifier **has a 75 milliampere carrying capacity, which is sufficient to operate five A-P Transmitting Tubes in parallel. For high power CW transmission, use additional *A-P Rectifier Tubes* in parallel.**

A-P Rectifiers **used in Type 0 A-C DeForest Radiophones, equipped with the SHAW standard condensite four-prong base, and licensed under SHAW patents. *Price $9.75.*** **Order from your dealer or direct from addresses below.**

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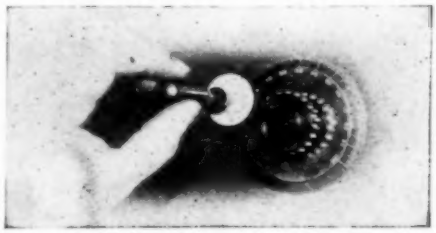
Distributors for Moorhead Laboratories Inc., Manufacturers of A-P Tubes.

Diagram of connections free with each tube

ANNOUNCING

GUSTAFSON VERNIER DIAL CONTROL

$1.00



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We now turn them out at one a minute and you can get them at your dealer or direct if you send us his name.

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GREBE RADIO

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Regenerative Receiver

performs at any wave-length within these limits.

Included in its range are amateur, commercial and Navy wave-lengths, special land stations, ship CW stations, Navy low-wave arcs, all radio phone work and "Time."

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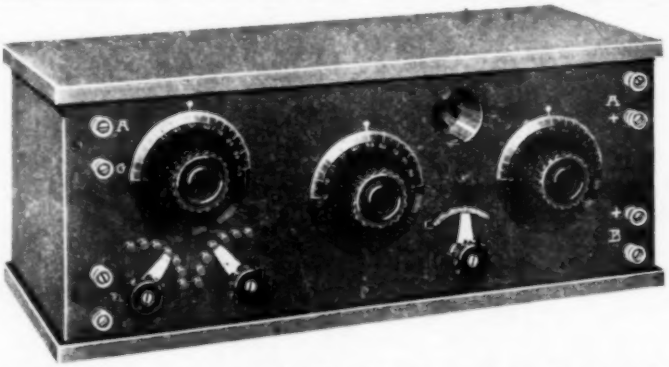
Assemble Your Own Regenerator



This short wave regenerative receiver was built with our parts. It comprises a fumed quartered oak cabinet, coupler, grid and plate variometers, grid and phone condensers, engraved formica panel with tube socket and rheostat attached, three dials and knobs, three switches and the necessary contacts, screws, stops, binding posts, etc., complete and ready for assembling.

PRICE $40.00

This receiver embodies the finest design, material and workmanship. All parts are accurately made and interchangeable. This receiver assembled has shown real results. It has no superior in either quality, construction or performance regardless of price. Only three tools are necessary to assemble this receiver, namely, pliers, screw driver and soldering iron.

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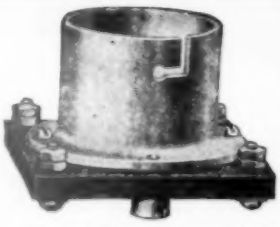

you intend spending for a grid leak. Buy the "Ace" Vacuum Tube Socket complete with Grid Leak mounted on base.

Ace V.T. Socket with grid leak....$1.50

Ace V.T. 4 tube socket mounting for C.W. Units 6.00

Ace V.T. Die Casting only without base ..... .55

Specify whether panel or table type is desired. If your dealer cannot supply you order direct from us. Dealers solicited. Mail orders given prompt attention.

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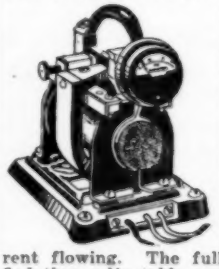
10c. Charges Your Battery AT HOME WITH AN F-F Battery Booster

and your station will never be closed because of a discharged battery.



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F-F Battery Boosters are automatic and operate unattended. Screw plug in lamp socket, snap clips on battery terminals and see the gravity come up.

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The F-F Booster is a Magnetic Rectifier for 105-125 Volt 60 Cycle Alternating Current.

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Also Boosters for 12 Volt Batteries

Shipping weight 10, 12 and 15 lbs.

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The France Mfg. Co.

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CW TRANSFORMERS 50 WATT ..**$15.00**— 200 WATT ..**$20.00**
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SERIES—PARALLEL SWITCH—NICKEL **85c.**
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Storage "B" Battery

McTighe 22 B-Battery **Lead-Aluminum Rectifier**
Patents Pending

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McTIGHE RECTIFIER **$2.00**
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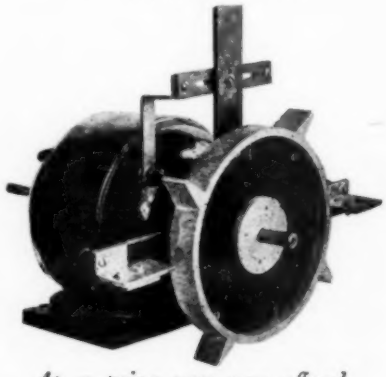
SYNCHRONOUS GAP?
Here is one



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4 or 8 tooth disc. Electrodes can be adjusted while gap is in operation. Motor runs on 110 Volt 60 Cycles A.C.
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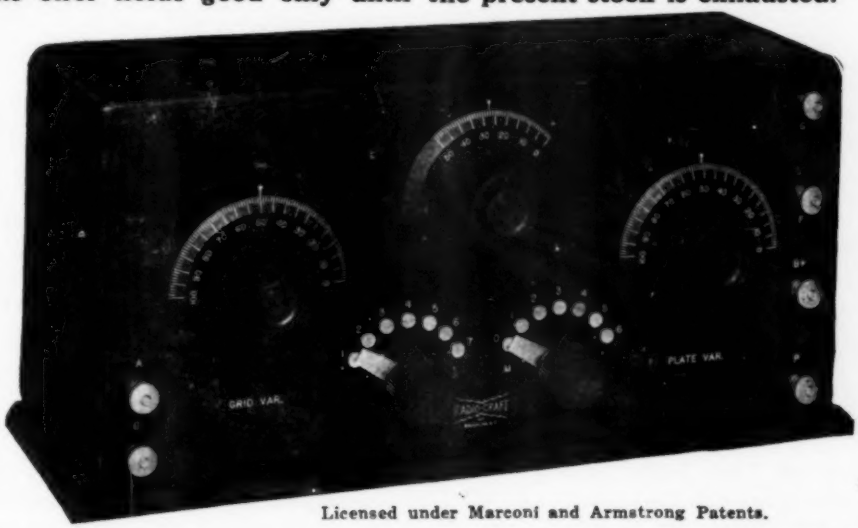

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Short wave regenerative receiving set with wave length range from 125 to 550 meters.

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Detectors & 1-stage Amplifier	$22.50
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Two-stage Amplifier	25.00
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DETECTOR AND TWO-STAGE AMPLIFIER
Size:—8½" x 8¼" x 4"

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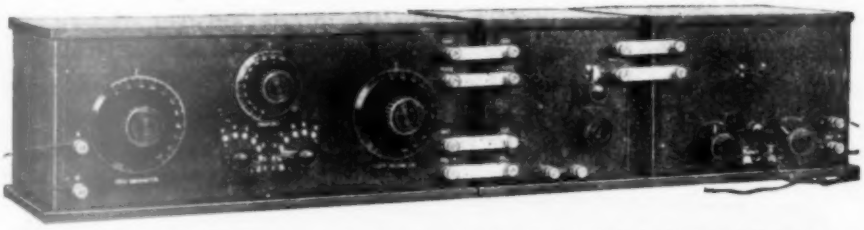
Jobbers Inquiries Invited

The QRN Season Is Almost Upon Us!



Do you want to work distance all summer? Why not equip your station with the very latest design in the Variometer type of regenerative tuner, at a price which places this improved apparatus within the reach of all!

This short wave generative tuner, fundamentally correct in design, covers a wave length range of from 180 to 550 meters, giving the highest amplification yet attained in this type of tuner, without changing the spark tone, and is unexcelled for radiophone reception. The parts are mounted on a velvet finished formica panel and inclosed in a solid mahogany cabinet finished in "Flemish" as beautiful in its appearance as it is efficient in its operation. Price $50.00.

CINO PRODUCTS

The Detector Cabinet contains the new General Radio rheostat, its large smooth surface giving the critical filament adjustment required by the present-day tubes. There is ample room for the "B" Batteries, a control switch for which is contained on the panel, enabling the operator to cut out his phones while transmitting. Price $18.50.

A two step amplifier which gives an amplification equivalent to 400 times that of the detector and is equipped with anti-capacity switches enabling the operator to change the phones from detector to one or two steps without adjusting the filaments as they are automatically cut in and out with the one operation. Price 40.00.

We invite competitive comparison with any regenerative tuner now on the market.

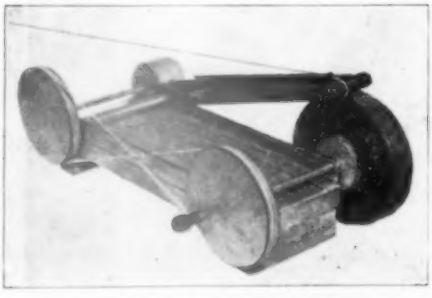
Write for descriptive literature. We also handle all standard makes of apparatus.

We build C-W Apparatus. Have you heard our phone? Call 8XY ex 8AIJ.

CINO RADIO MANUFACTURING CO.

218 West 12th Street, Cincinnati, Ohio

STAND BY



TEN DOLLARS

FOR A REAL

COIL WINDER

Guaranteed to wind lattice coils any size up to 2000 turns. Adjustable widths from ⅛ inch to 1¼ inch. Order today and wind all the coils you want.

Lambert and Associates, Mfrs.

A. W. HALLBAUER

DISTRIBUTOR OF

COIL WINDERS AND LATTICE VARIOMETERS

1001 N. LOCKWOOD AVE.,

Chicago, Ill.

Announcing

Seymour "A" Batteries

We are pleased to announce that we can furnish a real "A" battery at a price that is within the reach of all.

Think of it! A 6-volt 50-AH battery, seven plates per cell, and the price only

$16.50

Every one guaranteed for eighteen months. Any repairs necessary within that time done

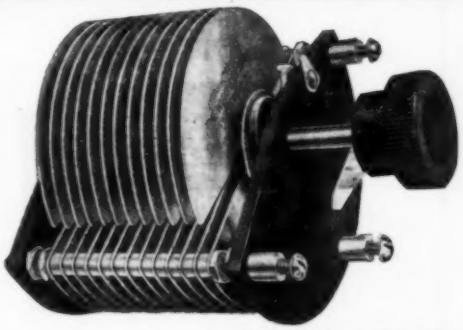
FREE OF CHARGE

IMMEDIATE DELIVERY

Dealers: Write us for prices.

SEYMOUR ELECTRIC CO.

Box 237, Seymour, Ind.



WANTED-- The Name of Every Radio Man Who Has Had Trouble With His C.W. Condenser.

This One Won't Give Trouble.

IF YOU ARE NOT ACQUAINTED WITH "WIRELESS SHOP" CONDENSERS—LET'S SHAKE.

We want every amateur who uses a variable condenser to know our product. Our new bulletin showing our entire line of variables will be mailed for the asking. Where shall we send your copy?

We build 14 different sizes of condensers, in three different types, and several special ones to order. The prices range from $2.00 to $10 00 for the standard instruments. Can any other manufacturer offer you anything like this in variables?

The NEW WIRELESS SHOP C.W. VARIABLE CONDENSER is designed to be used on CW sets where the plate voltage runs up to from 200 to 1000 or higher. You won't have makeshifts now. Get a condenser which is built especially for your C.W. set. The plates are widely spaced and the construction is rigid. Only the best of materials and workmanship throughout. Fully guaranteed to give satisfaction or your money back.

PRICES:

No. 1500 15 plate, approximately 0.0004 mfds. Max. capacity..$6.00
No. 2500 25 plate, approximately 0.0006 mfds. max. capacity.. 7.50
No. 3500 35 plate, approximately 0.0008 mfds. max. capacity.. 9.00

Regularly equipped with knob and pointer and mounting screws. A metal dial will be supplied instead of the pointer at 75c extra, or a high grade moulded bakelite knob and dial with graduations filled in white, will be furnished at $1.00 extra.

Postal charges and insurance must accompany your remittance. Insurance on any CW condenser is only 5c. Isn't it worth it?

THE WIRELESS SHOP
A. J. EDGCOMB

511 West Washington St., Los Angeles, Cal.

ORIGINAL SUPERIOR MIGNON SYSTEM APPARATUS

MIGNON-SYSTEM

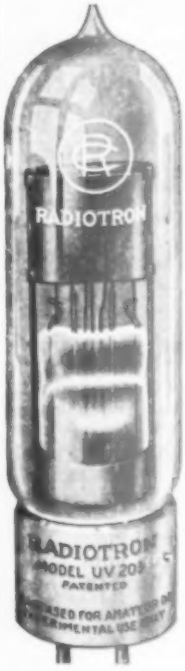
NEW INVENTION RADIO APPARATUS
WIRELESS TELEPHONE

WRITE FOR LITERATURE—IT'S FREE

MIGNON SYSTEM MFG. COMPANY

Buffalo, N. Y., U. S. A.

Radiotron Receiving and Power Tubes



UV200 Detector.....$5.00

Correct Accessories

.00025 mfd. Grid Cond. .25
6 step, ½-3 Megohm Leak ..... .75
Gen. Radio "A" Bat. 400 Ohm Potentiometer, panel Type 4.00
Gen. Radio Panel Rheostat 2.50
22V. Eveready "B" Bat. Adjustable.... 2.00

UV201 Amplifier.....$6.00
New Type Gen. Radio high impedance amp. Transformer fully mounted #231A.. 5.00
Paragon Rheostat.... 1.75
44V. Eveready "B" Bat. Adjustable.... 3.75

UV202 Power Tube..$8.00
.003 mfd. Mica Grid Cond. 2.00
5000 Ohm Grid Leak 2.25
Gen. Radio 2½ amp. Panel Rheostat.... 2.50

UV203 Power Tube..$30.00
.002 mfd. Grid Cond. 3.00
(special Mica—2000V Test)
C-E Variable 6000 ohm Resistance for G. Leak..... 3.00
Rheostat, use 2 Remlers in parallel, 6.5 Amps. 3.50
D.C. or A.C. Drive Esco 1000V. 200 watt Motor Generator, New Price..150.00

Type JX

A. C. Voltmeter

O-15 range, for the filament of Radiotrons—UV202, 203 and 204.
Jewel Bearings, Magnetic Vane Movement, Fine Construction and Appearance. 3¾" D. Guaranteed, same as our type J.

$8.00 POST PAID

TYPE J, D.C. VOLTMETERS

0—100Volts .... $8.00 0—1000Volts $24.00
0—500Volts .... 16.00 0—1500Volts 30.00
Including external resistance.

TYPE J, D.C. MILLIAMMETERS—$6.00

0—550, 0—100, 0—300, 0—500 M.A. Ranges. Famous for their accuracy and fine appearance, D'Arsonual movement.

GEN. RADIO HOT WIRE AMMETERS

O-¼, O-½, O-1, O-2½, O-5 and 0-10 Amps. They match the Type J and JX Meters in general size and appearance..... **$7.75**

Acme A.C. Fil. Heating Transformers

75 Watt fully mounted, $12; Unmounted $9.00
150 Watt fully mounted, $16; Unmounted $13.00

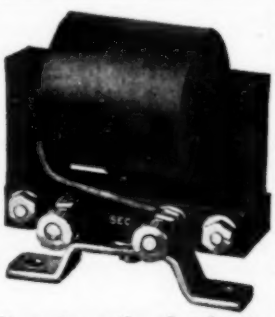
NEW! Somerville Dial, $2.00

4" Dia. #16 guage brass, grained, silver plated and lacquered to prevent tarnishing, clockwise rotation, three calibration scales, 2" navy knob, ¼" shaft bushing.

Somerville Radio Laboratory
Winter Hill, 45, Mass.

BATTERIES FOR PLATE CIRCUIT OF VACUUM TUBES.

NOVO MANUFACTURING CO.
424 W. 33d ST. NEW YORK
531 So. Dearborn St. CHICAGO



Rhamstine★ Radio Products

Audio Frequency
AMPLIFYING TRANSFORMER
Mounted $3.50
Add 10c for postage

Made of the very best materials,—laminated core of silicon steel, bakelite binding post supports, ratio of primary and secondary turns of the machine made coil accurately determined and thoroughly tested. The one-piece base is swivel mounted. All brass parts nickle plated and polished. Circular completely describing the transformer upon request.

Guaranteed Satisfactory.
Order yours today!

J. THOS. RHAMSTINE★
2152 E. Larned St., Detroit, Mich.
Dealers write for discount
Amplifying Transformers—Plugs and Jacks.

ARLINGTON TESTED CRYSTALS

For over five years the accepted standard for crystal detectors. Galena or Silicon, individually tested and packed in tin containers, post paid, 35c crystal.

25c

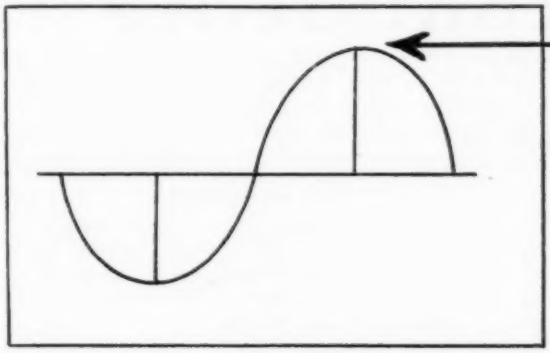
THE NEWMAN-STERN CO.
Newman-Stern Bldg. Cleveland, O.

$8.00

3000 OHM RED-HEADS.

Now only **$8.00** for complete head-set. At this price unquestionably the greatest radiophone value in the world. Write for bulletin describing Red-Head Radio Receivers.

THE NEWMAN-STERN CO.
Cleveland, O.



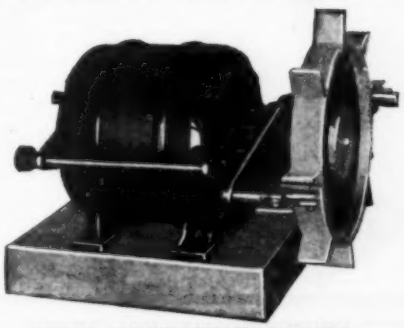
Get That Peak!

A SYNCHRONOUS GAP IS THE ONLY MEANS OF GETTING THE MAXIMUM DISCHARGE EVERY TIME AND THUS OBTAINING THE MAXIMUM FROM A TRANSMITTER FOR A GIVEN INPUT.

Synchronous gaps must be adjusted carefully and accurately. Friction or clamp adjustment is not sufficient. The Hyrad synchronous has gear adjustment of the rocker arm giving exceptionally fine variation. Motor supplied with the Hyrad synchronous operates directly from 110 or 220 volts 60 cycle alternating current and requires no external excitation.

Equipped with our balanced Hyrad disc. Machine work so accurate that adjustment of stationary electrodes may be made within .003 inch of rotor, and rocker arm rotated without hitting.

Supplied with special Tungsten Electrodes when desired for exceptional quenching.



HYRAD SYNCHRONOUS ROTARY

Hyrad Synchronous Gap, complete with motor, disc, and gear adjusted rocker arm mounted on finished oak base. F. O. B. Chicago.....$125.00
Tungsten Electrodes.....$3.00 each

All our prices have been reduced.
Catalog F-21 quotes new prices.

Chicago Radio Laboratory

Testing Station--9ZN--5525 Sheridan Road
We have moved! Note our new address!

6433 Ravenswood Ave., Chicago, Ill.

WIRE R T S MARKET

NOW IS YOUR OPPORTUNITY TO BUILD YOUR NEW SET

We can furnish you with the following sizes of magnet wire, neatly spooled. This is the highest grade wire obtainable.

Size	Weight	Double Cotton
No. 20	¼ lb.	49c
No. 22	¼ lb.	52c
No. 24	¼ lb.	58c
No. 26	¼ lb.	72c
No. 28	¼ lb.	92c

We charge nothing for Spools. When Ordering include postage.

AERIAL WIRE

JUST THINK—Nearly 2 ft. of pure solid copper No. 14 Aerial wire for 1c. (Order YOURS Now)
No. 14 Solid Copper Aerial Wire Per. 100 ft $0.58
No. 14 Solid Copper Aerial Wire Per 100 ft. $0.58 ft. $5.50.

DID YOU SEND 10c FOR THE R.T.S. CATALOGUE?

RADIO TESTING STATION BINGHAMTON, N. Y.

--your confidence

This is my first ad in QST. I want you to buy your radio supplies from me. I want to be known from one end of this country to the other as the man who makes the highest quality radio instruments. I extend prompt and courteous service to each and every customer. Your confidence is the most important object of the policy of the FADA shop.

My Policy

To earn the confidence of my customers by earnestly striving to deserve it; to better my product; to improve my service; and to develop so far as I may, a spirit of friendly and helpful co-operation between the entire FADA organization and the people I serve.

My Equipment

A modern, clean shop in which is installed lathes, drill presses, milling machines, punch presses, saw table and engraving machine. An experimental laboratory and testing station. A high-speed shipping room.

FADA Crystal Detector as illustrated	$3.00
Radiotron UV-200, $5.00; UV-201	6.50
FADA Super-sensitive Galena Crystal	.50
No. 1 Chelsea condenser .001 mfd. mtd.	5.00
No. 2 Chelsea condenser .006 mfd. mtd.	4.50
No. 3 Chelsea condenser .001 mfd. un-mtd.	4.75
No. 4 Chelsea condenser .0006 mfd. un-mtd.	4.25
FADA Control Panel with Auto-jacks	17.50
FADA Two-Stage Amplifier	50.00
FADA Detector and Two-Stage Amplifier	65.00

Watch for announcement of details of FADA instruments. Send me your order for supplies today.

FRANK A. D. ANDREA

1882-B Jerome Avenue, New York City

A BIG COMPANY — A BIG STOCK

A COMPLETE LINE OF STANDARD APPARATUS FOR EVERY RADIO NEED.

Murdock #55 Sockets	$1.00	Standard ground switch	$4.00
Radiotrons UV-200	5.00	Remler Detector control panel	8.00
Radiotron amplifiers UV-201	6.50	Remler Single amplifier panel 1	9.00
Radiotron power tubes UV-202	8.00	(These are the best value of any on the market)	
Weco 2 circuit jack and plug combination	1.50	Remler Junior filament rheostats	1.00
Stranded copper antenna wire, per foot	.01	Remler #81 filament rheostat	1.75
		Remler Dials	1.30

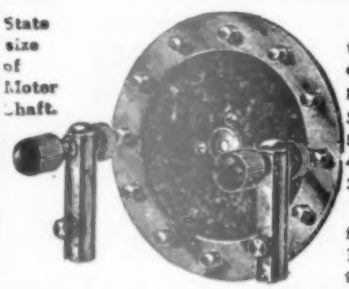
IMMEDIATE SHIPMENT — POSTAGE PREPAID

It will pay you to write for our special combination offer for this month—Save up your orders and send them to us.

WHITALL ELECTRIC COMPANY, Westerly, R. I.

CALL LETTERS 1IAP.

State size of Motor shaft.



Complete transportation charges prepaid.

Size	
5½"	$6.95
4½"	$6.25
3½"	$4.50

Get circular for Binding Posts & Contact Screws.

CONTINENTAL ELECTRIC COMPANY

117 East 129th St., No., New York, N. Y.

THIS APPARATUS SENT PARCEL POST PREPAID

VACUUM TUBES

Radiotron UV 200 Detector Tubes	$5.00
Radiotron UV 201 Amplifier Tubes	6.50
Radiotron 5 Watt Power Tubes	8.00

VACUUM TUBE ACCESSORIES

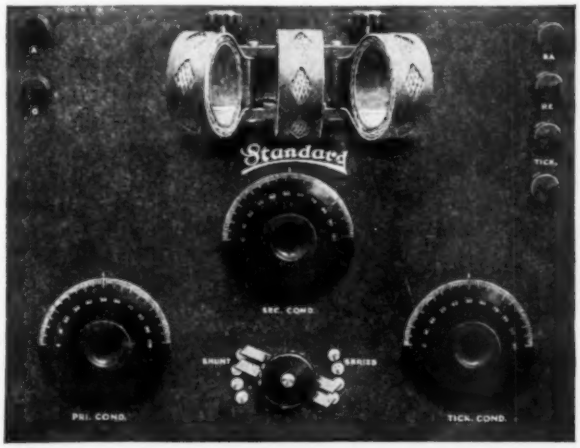
G. A. Grid Condensers each	$0.35
Murdock VT Sockets each	1.00
Paragon 6 Ohm Rheostats each	1.75
Paragon VT Control Panels each	6.00
Acme semi-mounted Amp. Transformers	5.00

What do you need? Write for our prices

FEDERAL RADIO & RESEARCH LABORATORY

20 RUSH ST., SOMERVILLE, MASS.

UNWIRED RADIO EQUIPMENT



The Multi-Wave Tuner illustrated is one of a complete line of radio instruments we are offering discriminating experimenters.

This instrument, as well as our Radiophones, Regenerative Receivers, Audion Controls, Amplifiers, and other standard units, is supplied both wired and unwired. You can use your own circuit with our unwired units or connect the units in accordance with blueprints supplied by us.

This tuner is constructed of the best grade standard parts, neatly mounted on a $\frac{3}{16}$" grained Formica panel size 11¼"x14".

The coil holder is of the DeForest geared type providing critical coupling between honey-comb coils with a range of wave lengths from 150 to 20,000 meters.

Chelsea dials with a one thousandth inch thick bearing eliminate warping and scraping common to other dials. The primary and secondary condensers are also of Chelsea make, capacity .0011 mfd. The Chelsea .0006 mfd. condenser is used for tickler tuning.

DeForest condenser switch is provided for throwing the primary condenser in series, with the primary coil, out, or in shunt.

The panel is neatly engraved in the pantograph style, the lettering being filled with a white enamel that will not crack or fall out.

The tuner is encased in a well made, black mission finished, oak cabinet.

The cost of our completely assembled, unwired instruments is but little more than the retail price of the standard parts and raw materials. Write for free booklet describing our complete line of unwired, assembled instruments.

Model No. 2	*Price*
Wired - - -	*$50.00*
Unwired - - -	*$45.00*
(without coils)	

STANDARD ASSEMBLING COMPANY

19 BRIDGE STREET, NEW YORK

$45.00

Quality Radio Equipment

RADIO MAGNAVOX TYPE R-3

Latest development in sound amplifiers; constructed on a patent protected electro-dynamic principle. Emits same volume of sound as higher priced Magnavox Telemegafone.

RADIOTRON U.V.202

New type Power Tube of improved operating characteristics. Provides long operating life. Rated at 5 watts. Filament voltage 7.5V. Filament current 2.35 amps. Plate volt. 350-400 V.

THORDARSON TYPE R—1KW TRANSFORMERS—SPECIAL PRICE $35.00.

Regular price $40.00. Overstock causes reduction

Full supply of quality Vacuum Tubes, Controls and Parts. Special Dealer's offer. Mail orders filled promptly.

Write for Radio Catalogue No. 2.

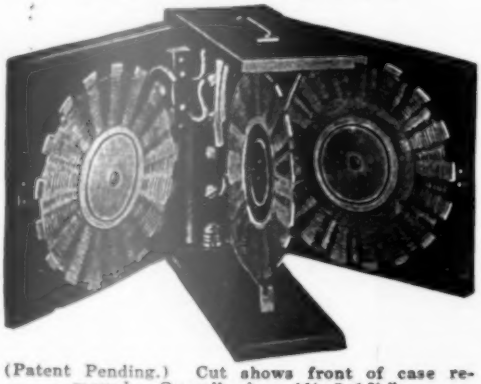
$8.00
(postage extra)

DOUBLEDAY-HILL ELECTRIC CO.

RADIO DEPT.—DESK A

715 12th St., N. W., WASHINGTON, D. C. 719-21 Liberty Ave., PITTSBURGH, PA.

THE TURNEY SPIDER-WEB REGENERATIVE UNIT



(Patent Pending.) Cut shows front of case removed. Overall size, 4½x5x1¾".

PRICE NOW $8.00

This new form of coupling is simple, effective and capable of very fine adjustment. The doors which carry the two movable coils are hung with a carefully thought out constant friction arrangement which is not effected by atmospheric conditions and will stay exactly where placed. With two condensers, .0005 m.f., this set will respond to wave lengths from 180 to 400 meters and give results such as you have not had before.

PACIFIC COAST AGENTS HERROLD LABORATORIES } SAN JOSE CALIFORNIA

WHAT WE CLAIM—

FIRST

Practically no magnetic leakage, which means more mutual inductance and stronger signals.

SECOND

Less distributed capacity than any form of lattice winding which means finer tuning.

THIRD

Occupies much less space than any other form of winding.

FOURTH

It is the best $8.00 worth of Radio you ever saw.

Ask your dealer to show you one or send us $8.00 plus postage. We will ship it same day order is received.

Our files contain many letters stating that this little set surpasses in efficiency anything now on the market regardless of price. What more can you ask.

EUGENE T. TURNEY LABORATORIES
Radio Hill, Holmes, New York

CONCERTS EVERY NIGHT!

Easy when you know how. Ask us.
Our special offer during May and June on parts for DETECTOR & 2 STEP AMPLIFIER is what you need.

10% DISCOUNT

2—Federal Amp. Transf.	$15.00
1—Radiotron UV200	5.00
2—Radiotron UV201	13.00
2—Navy Cage Type Rheostats	4.00
3—Rhamstine Jacks & Plugs	4.50
10—Nickle Binding Posts	1.50
50—Soldering Lugs	.50
1—L. P. F. Panel 10x7½"	1.50
1—G. A. Grid Condenser	.35
VALUE	$48.85

OUR PRICE NOW $44.00 PREPAID

10% discount on any of above items if you send us names of 5 Amateurs not in Call Book. Order today.

Send stamp for latest Bulletin.

Write us your troubles. Free advice from our experts. 12 Years Radio experience.

RADIO SUPPLY SERVICE

Specialists in Reception Apparatus And Parts.

46 Clinton Place, Mt. Vernon, N. Y.

Pat. Applied For.

REMLER No. 93 A-BATTERY POTENTIOMETER

Increases detector sensitiveness and signal audibility.

The plate voltage of any detector tube must be carefully adjusted for maximum sensitiveness and signal audibility. Potentiometer control provides close adjustment with ease of operation. This Remler Unit is not brittle and is connected across the A-Battery to control the plate potential over a six volt range by half-volt steps. Circuit diagram furnished with each unit.

No. 93—Remler A-Battery Potentiometer Unit only with studs for panel mounting .75c

No. 94—Remler Rotary Lever Switch for use with No. 93 Unit .45c

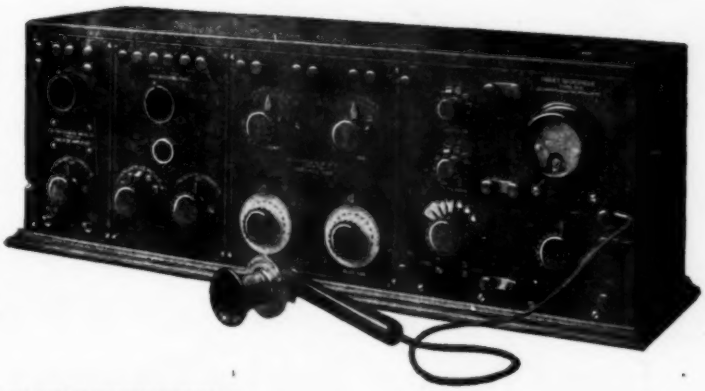
Complete 200 page catalogue will be sent upon receipt of 35c.

LEO J. MEYBERG CO.
Successors to Haller Cunningham Electric Co.
428 Market St., San Francisco, Cal.

De Forest
RADIOPHONE
REG U S PAT. OFF.

"INTERPANEL" SET

Complete Set of Five Panels, shown here, mounted in cabinet; without batteries or tubes; Type MS-1; $189.25. Panels also sold separately for mounting in home-made cabinet; or with legs for Vertical or Horizontal Table Style mounting.



COMPLETE RADIO TELEPHONE TRANSMITTING AND RECEIVING APPARATUS WITHIN THE REACH OF EVERY AMATEUR!

COMPLETE Set, as illustrated, comprises "RADIOPHONE" transmitting speech 30 miles minimum; 500 mile range possible under favorable conditions. Short Wave Tuner; Audion Control Panel specially designed for gaseous tubes; and One-Step Amplifier. Additional Steps of Amplification may be added.

Only one 6-volt storage battery required. Motor-generator, "B" battery or rectifier power supply may be used. Unlimited reception possibilities.

The "INTERPANEL" system is the most convenient and least expensive way to buy Radio Apparatus. Each panel a complete piece of apparatus, and designed for combination with other panels to form an entire set. Find out more about it now.

Ask Your Dealer for the New "INTERPANEL" Catalogue.

Or write direct to us for further details and prices on this new DeForest Development.

DeForest Radio Telephone & Telegraph Company

Inventors and Manufacturers of High Grade Radio Apparatus

1415 SEDGWICK AVENUE **NEW YORK CITY**

Get a Copy of Our Wireless Manual H-12

We ask 25 cents for it, give a coupon receipt for the amount which coupon when returned with an order will be credited at 25 cents.

As the edition is limited, if you desire a copy, send the 25 cents and get it now for future reference.

It contains 200 pages, fully illustrating and describing the many instruments used in Radio service. Forty-five pages are devoted to general instructions, diagrams, station calls, tables, codes and other information identified with the art. The book is printed on highly finished paper with a two-color cover; size 9x5¾ inches.

With a large and varied supply of wireless instruments and accessories carried in stock, we are in position to fill any order or meet any condition promptly and accurately.

We have experts in charge of our wireless departments, so do not hesitate to consult us about your wireless problems. Proper attention and accurate information is yours for the asking.

MANHATTAN ELECTRICAL SUPPLY CO., Inc.

17 Park Place, New York; 114 So. Wells St., Chicago; 1106 Pine St., St. Louis; 604 Mission St., Frisco.

A REAL KEY!

This is but one of our good instruments, ask us about our audion control and amplifier panels, sockets, spark gaps, crystal and other detectors, grid and phone condensers, grid leaks, etc.

10	ampere capacity key	$6.00	each
20	" " "	6.50	"
30	" " "	7.00	"

Specials in switch points, all polished nickel plated:

Style No.	Diam. Head	Height head	Shank	Thread	Dozen
1061	¼"	¼"	5/16"	6x32	$0.40
1062	¼"	¼"	5/16"	6x32	0.38
1063	7/32"	7/32"	½"	4x36	0.40
1068	¼"	1/8"	3/16"	6x32	0.35

Above complete with nuts. Postage extra

1041	¼"	3/16"	tapped	6x32	0.38
1042	¼"	¼"	"	6x32	0.35
1043	3/16"	3/16"	"	2x56	0.35
1044	3/16"	¼"	"	2x56	0.35

Above complete with ½" screws. Postage extra

Special in Binding Posts, all polished nickel plated.

No. 73 Panel Binding Post composition knob, screw and washer complete ¾" high....$1.10 doz.
No. 74 Panel Binding Post similar to above but smaller, ½" high.....$1.00 doz.
No. 27 All metal post polished nickel ½" diam. ¾" high.....$1.45 doz.

20% discount in lots of 100, postage extra.

Ask us about the U. S. Storage Batteries, the best low priced, high grade storage battery on the market, fully guaranteed. State size desired.

We manufacture over 5000 styles of small parts in metal, hard rubber, bakelite and other materials. We have just what you want or will make it for you. Dealers will do well to get in touch wth us. Insist on E.P.E.I. CO. quality.

Eastern Precision Electrical Instrument Company
ROCKVILLE CENTRE, N.Y.

The Jupiter News

VOL 1. MAY, 1921. NO. 3.

"Jupiter" Cage Aerials

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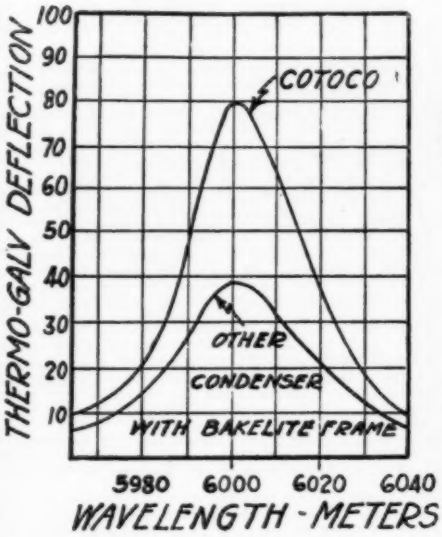

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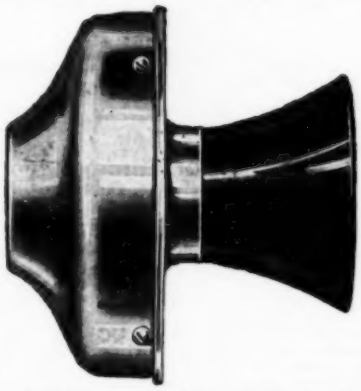

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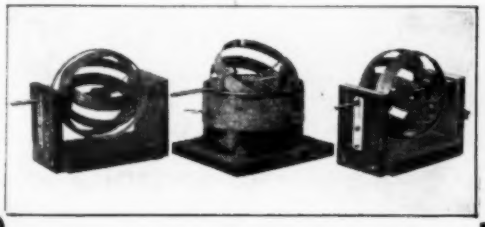

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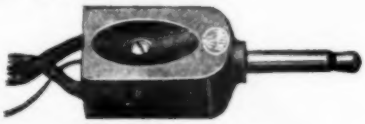

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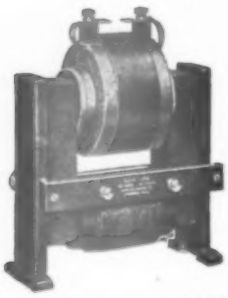

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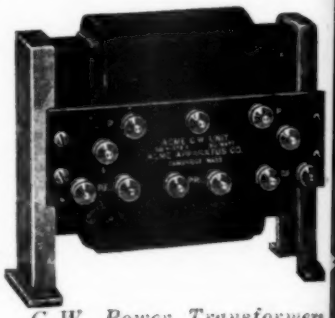

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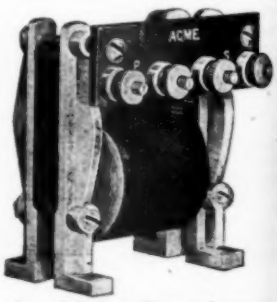

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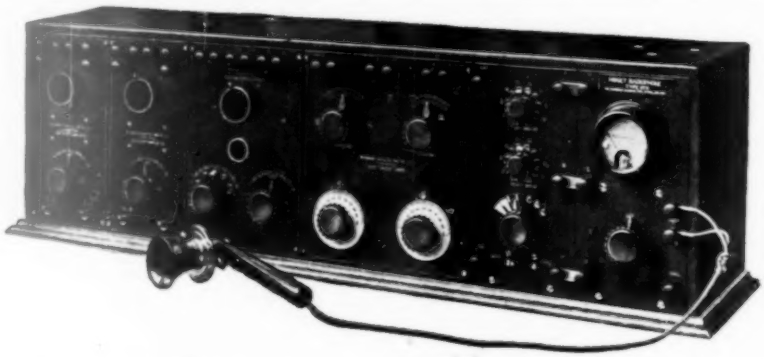
JUNE 1921 20¢



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Rose Radio Supply,
604 Gravier St.

NEWARK, N. J.
A. H. Corwin & Co.
4 West Park St.

OMAHA, NEBRASKA
O-B Radio Supply Co.
406 Brown Building.

PHILADELPHIA, PENN.
Philadelphia School of
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Broad and Cherry Sts.

PITTSBURGH, PENN.
Radio Electric Co.,
3807 Fifth Ave.

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Atantic Radio Co.,
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PROVIDENCE, R. I.
Rhode Island Elec. Equip. Co.
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SCRANTON, PENN.
Shotton Rdio Mfg. Co.
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Branch, 8 Kingsbury St.
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WASHINGTON, D. C.
Eastern Radio & Electric Co.
1405 Florida Avenue.

WICHITA, KAN.
The Cosradio Co.
1725 Fairmount Ave.

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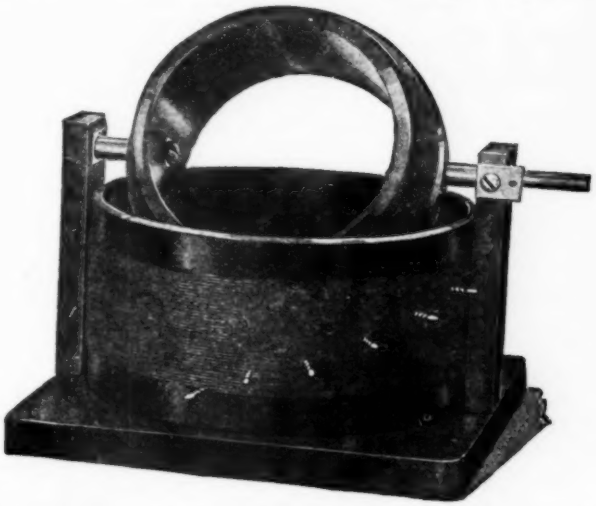

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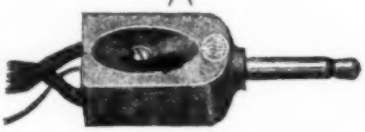

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